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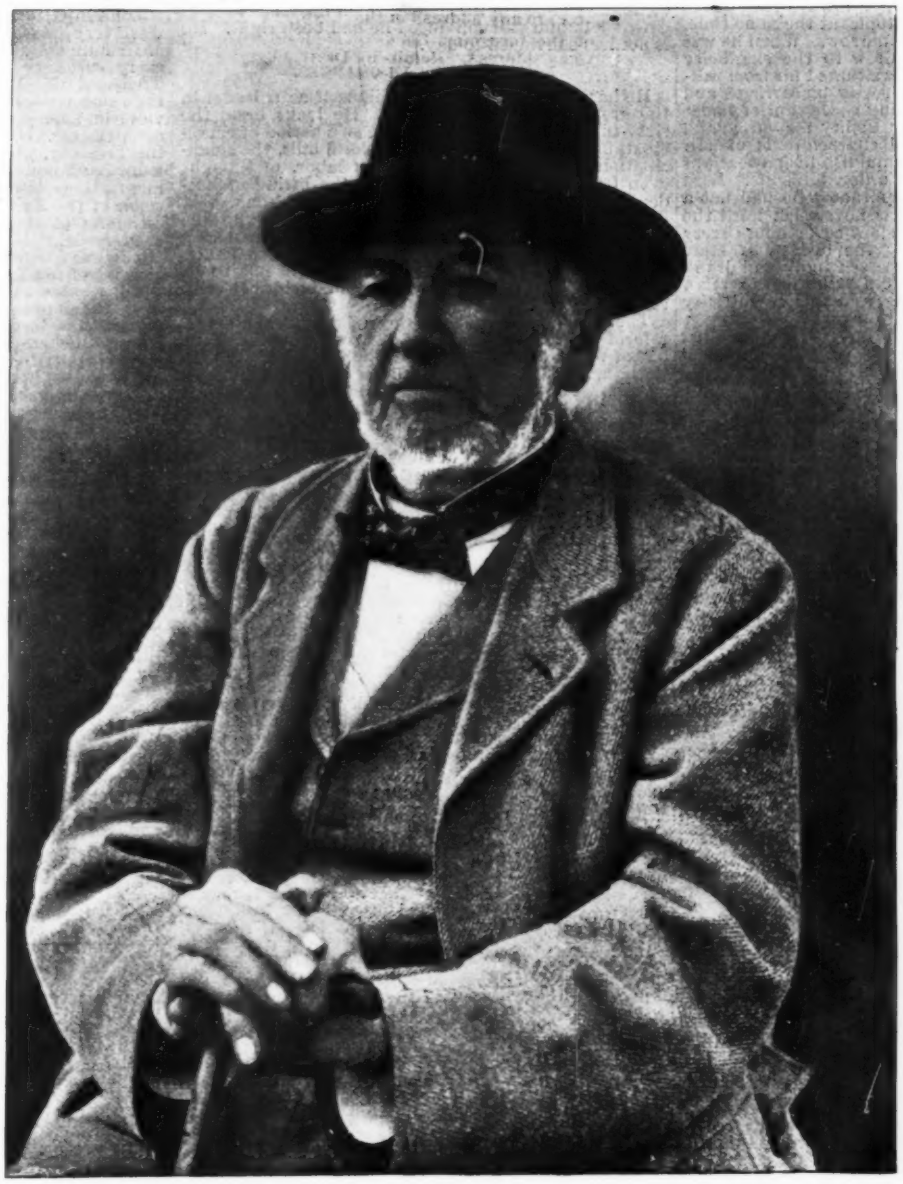


Photo by Numa Blanc Fils, Cannes

THE RIGHT HON. W. E. GLADSTONE

HIS LATEST PORTRAIT

DEATH OF MR. GLADSTONE.

TO-DAY the world is mourning the loss of its greatest citizen, and the news of the death of Mr. Gladstone has produced a profound impression which even the exciting time through which we are passing does not efface. His influence upon the morals and politics of his time were not at all restricted to Great Britain, and among the statesmen of the world he has been recognized as the consummate type of intellectual force controlled by stern morality.

Mr. Gladstone was born at Liverpool on December 29, 1809. While English by birth, he was of Scotch descent. In 1821 Mr. Gladstone entered Eton, where he spent the following six years. He early showed the literary bent of his mind. After two years more of study with a private tutor, young Gladstone went, in 1829, to Oxford, and became a member of Christ Church. On his examination, in 1831, he carried off the highest honors of the university. After leaving Oxford, Mr. Gladstone spent some time on the Continent, and he was in Italy in 1832, when he was summoned home to enter upon public life. For the consideration of "Gladstone and his Place in the History of his Time," the reader is referred to the next article, which gives an able and broadminded view of Gladstone's force in the political world.

Mr. Gladstone's career has not all been a political one, for, though he has been known not only as a great statesman and an adroit politician, the religious world has known him as an able controversialist and classical scholarship is his debtor for works on Greek mythology and classical lore which showed profound study and appreciation. His life was methodical, and his recreation was but turning from one kind of work to the other. He is said to have always read three books on three widely varying topics at the same time, so that he might not become narrow. When he was not active in politics he withdrew to the simplicity and quiet of Hawarden, which is situated far from railroads and is even difficult of access by carriage, and from his quiet study came a long succession of books and pamphlets. This singular ability for varied and excellent work was a marked characteristic of Mr. Gladstone. That age did not diminish his powers was due to the ease with which he ordered his life. Lord Beaconsfield once said of him that "he had not a single redeeming vice." He was never sick until the very last years of his life. He slept seven hours every night, no matter how heavily the burden of state affairs rested upon him. He ate sparingly and drank with great moderation. His only physical exercise, except walking, was tree felling, and this eccentricity of his is known all over the world.

He was of medium height, but of commanding figure. In age his shoulders were slightly rounded. In early life he had jet black hair in abundance. He had piercing eyes, a bold nose, firm lips and a square jaw. His expression was earnest and stern, yet kindly. Probably no man has ever been so much caricatured as he.

Mr. Gladstone died at five o'clock A. M. on May 19. He had been seriously ill for the past nine months, but he passed peacefully away, thanks to the destruction and numbing of the nerves caused by the progress of his disease.

The government will accord him a public funeral, and the body will be interred in Westminster Abbey. Parliament will be asked to vote a national monument. The only precedents for Parliament voting funerals and monuments are the cases of Chatham, in 1778, and Pitt, in 1806. For our engraving we are indebted to Black and White.

GLADSTONE AND HIS PLACE IN THE HISTORY OF HIS TIME.

By GEORGE W. SMALLEY.

THE following article is by one who has had rare and intimate opportunities of acquainting himself with the life and character of the dead statesman. The article is from the New York *Herald*.

He has been the greatest opportunist of his time—such, I imagine, will be the verdict, or one of the verdicts, upon the extraordinary being whose long illness and suffering makes England—America also—anxious and sympathetic. Of course I attempt no summary of his career. The mere facts would fill a page, or a volume, or many volumes. Mr. John Morley, it is said, will be his literary executor and his biographer. There could be but one better choice, Lord Rosebery, and I do not suppose Lord Rosebery would, or could, undertake it.

The mention of Mr. Morley's name suggests at once the great difficulty in Mr. Gladstone's life and in the writing of his life. The difficulty is home rule for Ireland, on which Mr. Morley was a chief adviser. It has left a shadow on Mr. Gladstone's fame. As one looks back to 1886 and thinks of what happened then, and has happened since, the tragedy of the great man's life looms large. Had he laid down his burden of years and achievements a little before that, his place in history had been different. Then, one would have said, as he himself said of Mr. Bright, *felix opportunitate mortis*. Now a different epitaph will have to be chosen.

"Lord, who shall abide in thy tabernacle?" asks David, and answers, "He that sweareth to his own hurt and changeth not." If that were the only category of those entitled to that comfortable dwelling place, it would not be Mr. Gladstone's. He has changed too often, and too often at the time when the change in his political convictions coincided with political exigencies. But there is also a mansion for him "that walketh uprightly and worketh righteousness, and speaketh the truth in his heart"—the truth, if not the whole truth. And there we may find the great tory-liberal.

MR. GLADSTONE'S CHARACTER.

We all know the outline of Mr. Gladstone's history. In what I have to say of him to-day I shall assume that it is known. The character, not the career, is what I try to sketch, and even of that only some salient features. There is no great use in making an inventory of traits or qualities. If one did, I think courage would have to be put first. That, at least, has never varied. All his life long Mr. Gladstone has had something more than the courage of his opinions. He has had the courage to change them and not to be ashamed—the courage of many successive sets of opinions. I do not hint that he ought ever to have been ashamed, even in 1886. The one thing which changed not was his confidence in himself. It was always Athanasius *contra mundum*. There is nothing the world respects so much. Men like to be not only led and governed, but defied—elsewhere than in America. A minority is a force because it is a minority, and a minority of one is the greatest force of all.

Yet never, or almost never, has Mr. Gladstone found himself in any such solitude by his own choice. What he has cared for has been power, and, therefore, majorities as the means of power. A boundless ambition was his. To be four times Prime Minister of the greatest empire in the world was not enough. If he could have broken in pieces the empire over which he ruled, he would have died happy. Of course, his purpose never pictured itself to his own mind in that way. To him the dismemberment of the kingdom was external; a mere political rearrangement. Home rule was to be a union of hearts. As to all politicians who are also theologians, political casuistry was to him a delight. He expected to succeed when he entered upon this gigantic experiment. When he had failed he still thought he ought to have succeeded. The disruption of his party may well enough have seemed a slight matter to him who had resolved on the disintegration of a kingdom. He faced it with composure. He saw Bright, Lord Hartington, the Duke of Argyll, Mr. Chamberlain, and all but two or three of the leading liberals depart from him. It never shook him. He himself remained—what mattered who went? The Cabinet? The Cabinet was Gladstone. His courage was splendid—perhaps it was not politics. A long struggle, three complete changes of his scheme, then final, irrevocable defeat left him still convinced he had been right. He is not less convinced to-day.

NOT A LEADER IN CHANGES.

He has of late years regarded himself as a leader in the great processes of change. He looks upon the sixty-three years of his public life as a period of emancipation. Three great political reform bills, the emancipation of the voter, of trade, of labor, of thought even (religious thought excepted), the lifting of burdens from those least able to bear them—one great figure, and that his own, taking his march down these successive years from period to period, and scattering plenty and fair prosperous days over a smiling land—such is Mr. Gladstone's conception. It will not, so far as he is concerned, stand the test of historical criticism.

There has been, during all those sixty years, no great reform of which he was not at first the opponent, no one of which he was the true author, no one of which he became the advocate until its success had grown certain. That may be read as a reproach or a eulogy. I mean it neither as one nor the other. I only record the fact. Until you accept it as a fact, you cannot understand Mr. Gladstone. The spirit of the martyr was never his, or never in politics. He was, before he entered the House, opposed to the Reform bill of 1832, which transferred power from the aristocracy to the middle class. He first opposed Disraeli's bill in 1867, which broadened the suffrage and gave the skilled artisan his share of political authority. When it had become inevitable, he accepted it and passed the bill. He long opposed or silently obstructed the county franchise bill, of which Sir George Trevelyan was the author and untiring advocate—the bill which, in 1884, made England a democracy and the laboring classes a majority. He first opposed and then supported Peel's free trade, of which he became afterward not only a champion but an administrator.

There are other examples hardly less striking. Is that the record of a man who leads or a man who follows? When a movement became irresistible he joined it, and then he was himself irresistible. No man ever brought more varied powers of industry, acuteness, political genius of all kinds, to the service of the causes he espoused on the eve of their triumph.

But his genius was essentially destructive. He has been praised for constructive statesmanship. The two words sum up the popular misconceptions about Mr. Gladstone. It is hard to deny the name of statesman to a man but for whom, beyond doubt, the history of modern England had been widely different from what it is. On almost everything he has left an impress. The institutions of his country seemed at times to be but clay in the potter's hands, and Mr. Gladstone the potter. Some he remoulded, others he shattered, but what did he create? How can he be compared with Prince Bismarck, the greatest constructive force of our time; or with Cavour? Is he a man of generative ideas like Mazzini? I take the two men, the great German and the Italian revolutionist, who are perhaps widest asunder. A place midway must be found for Mr. Gladstone. An idealist like Mazzini he was not, and he was not a builder of empire like Prince Bismarck. The greatest men in public life have always been one or the other.

HAS SEEN THE EMPIRE GROW.

The British empire has grown and broadened in Mr. Gladstone's time. The map of the world is a great deal redder than it was when the Duke of Newcastle first made this promising young tory member for the rotten borough of Newark. But his were never the hands which willingly grasped new territory. He was of the school which thought colonies and dependencies a source of weakness, save in so far as they were markets. He would not have gone to Egypt if he could have helped it. He would not have staid there if he had dared come away. It was not he, but Sir Beauchamp Seymour who bombarded the forts of Alexandria. And who has forgotten the reluctant hand he slowly stretched out to Khartoum, too late to save Gordon, who had saved him, and whom he did not like? The Cape, Canada, Australia, Asia—in which of these has Mr. Gladstone's policy been primarily imperial as imperialism is now understood?

Nor can any great part of Mr. Gladstone's great fame be set down to his foreign policy. He could never have been a great foreign minister—never a Palmerston or a Salisbury. He suffered—for as Prime Minister he was responsible for the foreign policy of his government—the encroachments of Russia in Central Asia, of France and Germany in Africa—nay, even of the Transvaal, yielding to the Boers after a defeat. He cried out "Hands off!" to Austria and took it back. He proclaimed that Jefferson Davis had made a nation—that, also, he had to take back. Perhaps his boldest act was the vote of six millions sterling to make Belgium safe—far bolder than his Bulgarian agitation, which had for its immediate object the overthrow of Disraeli. The type of proconsul he liked was Lord Ripon as Viceroy of India, who governed India on the principles of sentimental radicalism, and made the government of it a more perplexing problem than ever to his successors. He was content with such a Laodicean as Lord Granville for Foreign Minister. When Lord Rosebery succeeded to the Foreign Office, he took it upon condition that he should have a free hand—his views of foreign policy, and not Mr. Gladstone's, were to prevail, and did prevail. The policy of England has since had a continuity which it lacked while Mr. Gladstone felt himself at liberty to undo the work of other ministries. The authority of England has grown as his own diminished or departed. She is a greater European power than he would have allowed her to become; her authority in the councils of Europe is far greater.

Well, but if a statesman be supreme neither in domestic nor in foreign policy, in what does his supremacy consist?

GREAT IN FINANCE.

Probably Mr. Gladstone was greater in finance than in any other branch of public business. He was preeminently a Peelite; that was his true place in politics. Sir Robert Peel was his master, and the pupil was worthy of the master. The problems involved in the reconstruction of the fiscal system of Great Britain after the repeal of the Corn Laws were those with which Mr. Gladstone was best equipped to deal. He was a very great Finance Minister. His budget speeches are monuments. That of 1853 remains a model which every successor has vainly sought to equal. The Treasury, the Exchequer—there he has shone. At the same time, his unrivaled skill in finance and his views on money matters lessened his efficiency in other departments. He was a ferocious economist. Between the Treasury, which in the English system of government is all-powerful, and the great spending departments, there is a never-ending struggle. The Chancellor of the Exchequer cuts down almost at will the estimates of the War Office and the Admiralty. If they resist, there is an appeal to the Cabinet. Mr. Gladstone in such a contest was almost invariably on the side of the Treasury.

But whatever deductions have to be made hereafter from the immense fame which has been Mr. Gladstone's these last thirty years, or since he first became Prime Minister, enough will remain to content any ordinary appetite. His departure will change the face of things as his presence has changed them. The death of Palmerston ended an epoch of repose. The death of Gladstone may end another. It has not been the fashion to speak of his career as a period of repose, or to associate the idea of repose with energies so restless as his. But in his time, so far as the internal affairs of England are concerned, the changes have been chiefly political. His activity has been political. He has been of late years radical enough in politics, yet he has remained a conservative force. How conservative his influence has been will be seen when it is removed. It is already seen. He was driven from office in 1894 by his own followers, or by certain sections of them. They were impatient of the restraint his presence and his counsels and his abiding authority imposed. With radicalism as they understood it, he had little sympathy. Much of the Newcastle programme was distasteful to him. They knew home rule was dead, and that it was too late to expect their great leader to take up any other great cry by which they might recover their hold on the country. They wanted to abolish the House of Lords, which he—and Lord Rosebery also—only wanted to reform. The party had split into cliques and coteries. It was no longer the historic liberal party. It was no longer Gladstonian. Day by day it was becoming more democratic and more socialistic.

ATTITUDE TOWARD DEMOCRACY.

To democracy Mr. Gladstone had no invincible aversion, for he had made the multitude his conscience long before. But to socialism he was an inveterate foe. He did not want to see society reconstructed in whole or in part. He was for leaving the foundations of things as they are. He saw in many of these new schemes a menace to all he held most dear, and to the Church most of all. It was always thought possible he might disestablish the English Church, as he had disestablished the Irish Church in 1869. But if he ever brought his mind to that, it would be in the hope of strengthening, not of destroying, the real Church—of making the ecclesiastical and spiritual and religious organization stronger by its severance from the State. That, again, was not what the radicals, and, least of all, the nonconformists, wanted. On hardly any point of large policy were they and their chief any longer in accord. He recognized the fact sorrowfully, and laid down his leadership in a speech more profoundly pathetic than if his opponents, and not his supporters, had forced him to resign. And the radicals have ever since been growing more radical and more reckless.

Men thought and said, when he bade farewell to the House of Commons, that the House would never again be the same. It was said of Peel. It was said of Disraeli. They and Mr. Gladstone were the three greatest members of Parliament of the century; perhaps of any century. Yet the House has gone on its way. Before he left it he had seen the decay of its ancient standard of decorum and of good feeling and of honor. The invasion of the new men, the invasion of the Irish irreconcilables, his own later alliance with Parnell and his band, his enforced tolerance of their outrages—these things had more affected the demeanor and authority of that body than could his departure. Yet his name as a great member of Parliament will live in tradition and pass into history untouched by time. There was none other like it; no leader with the same power of lifting a debate into the higher and purer air; none his equal in debating power; no such personality; no other man with the same vastness and range and accuracy of knowledge; none other wielding an authority in this Mother of Parliaments at all comparable to his.

There it was that his marvelous gifts had freest scope. He was a nobler orator in the House than on the platform. The temptation to play to the gallery was removed. Never the equal of Bright in pure oratory, he was often more than his equal in mere debate. He understood dialectic better; perhaps understood the House more completely. Bright also could create an atmosphere of his own, in which he delighted to move and to make others breathe. They two, and they only.

ONE OF THREE.

*A House without Mr. Gladstone we see, but England without him, the world without him, that, we may hope, is yet for a time deferred. There is no temptation to anticipate an event which will make England and the world the poorer. When criticism has done its worst, the august personality remains. He has been a kind of primeval force. To have known him is to have known one of the three men who, in our time, have dominated, each in his own way, the country of each. Lincoln, Bismarck, Gladstone, they are the three who stand apart.

Most men seem to us great by what they have done, and whether in letters or in arms, or in the great acts of public life, these men often loom less than their achievements. Not so Mr. Gladstone. He is greater than his deeds. None can ever have met him with a sense of disappointment. If he had done nothing, he would have been great. He towered above others. His conversation combined, as did none other, both charm and authority. There was a glamor in his mere presence. He laid a spell on you, fascinated you, subordinated others to himself. His eye had in it a command; his voice, the note of the trumpet on the field of battle. Character, that is the man, said Emerson. Profoundly religious, profoundly emotional; secretly arrogant, with the words of humility on his lips; an interest and an intelligence that embraced all subjects, human and divine; a simplicity which was complex; an unmatched gift of concentration of all his intellectual powers, at any moment, on any subject, to the exclusion of all others; and a never-failing conviction that he was born to great place and great thoughts and a great life—these are but some of the secrets of a power which, in its kind, the world has seldom seen; and still may see in the weary Titan who is slowly dying at Hawarden.

ADMIRAL CERVERA.

WE present an engraving of Admiral Pascual Cervera y Topete, who commands the fleet of armored cruisers and torpedo boat destroyers commonly known as the "Cape Verde Fleet." Admiral Cervera, who leads this modern Spanish armada, is very interesting to the public at the present time. He is one of the most distinguished of the Spanish officers, having rendered services in many battles. He bears medals for the Cuban war, engagements in Africa and the Carlist war. He has also been decorated with the crosses and orders of naval and military merit—Isabel the Catholic, Saint Hermengil and the Legion of Honor. He is entirely different in appearance from the ordinary Spanish admiral who is so often seen caricatured. He appears to be a man of considerable sagacity and with singular talent for strategy. Whether his deeds will bear out his reputation the next few days will disclose. When on the eve of leaving St. Vincent, Admiral Cervera made the following speech to the soldiers:

"After a three years' struggle in Cuba we are now about to see the end. Assuredly the insurrection would not have lasted had it not received support from the United States. That nation, believing that by its underhand work it had created a thousand embarrassments for us, and seeing that it could not attain the object of its ambition, at last threw off the mask when it saw the insurrection dying out and declared against us a most unjust war.

"It will be known to history that Spain did not want war, as is proved by her making every concession possible to a self-respecting nation; but the Americans, whose ambition is insatiable, always demanded more, and asked even what belongs to us, the country which the Spaniards discovered under the leadership of Columbus.

"Let us then go to war, since we are driven to it by the blind ambition of the Americans, but we shall enter the fight as Spaniards have always entered, strong in our rights and trusting in God, who will not abandon a just cause and who will sustain our efforts.

"I need not counsel you to observe discipline, for in the six months I have commanded you I have only had cause to congratulate myself upon your conduct. I need not, either, call upon you to give proof of conscientiousness in attention to duty, especially that of keeping watch—a task that is often irksome. Still less need I commend to you courage.

"You are Spaniards. That suffices in war. Then, when I lead you in battle, I will have confidence in my officers and my men, and the nations which are watching you will see that the Spain of to-day is the Spain of all times.

"Long live Spain! Long live the King! Long live the Queen Regent!"

Our engraving is from La Ilustracion Española y Américana.

CALCIUM CARBIDE AND ACETYLENE.

AT the meeting of the Institution of Civil Engineers, on March 15, a paper on "Calcium Carbide and Acetylene" was read by Mr. Henry Fowler, and is here abstracted by Nature.

Acetylene was first isolated by E. Davy in 1837 from potassium carbide, a by-product of Sir H. Davy's method of manufacturing potassium. In the middle of the century Berthelot investigated its properties, and Wöhler produced it from calcium carbide. During the past few years it has assumed commercial importance owing to the development of the electric furnace, in which calcium carbide can be readily produced from lime and carbon. The furnaces used consist essentially of crucibles with carbon rods forming the positive electrode and a bottom plate lined with carbon for the negative. In the more recent furnaces these crucibles are mounted on small trolleys so that they may be run out of the furnace when ready and a fresh one inserted without loss of time. The carbide formed is a hard, dense substance of reddish color, unacted upon by most of the ordinary reagents. It is, however, rapidly decomposed by water into acetylene and lime, giving 5·9 cubic feet of acetylene, at a temperature of 60° F. and a pressure of 30 inches of mercury, per 1 lb. of carbide. As the power required theoretically to produce 1 lb. of calcium carbide in an electric furnace is more than 2 horse power hours, its manufacture is at present restricted to localities where power is cheap, as, for instance, where water power is available.

Acetylene is a colorless gas with an intensely penetrating odor, and is slightly soluble in water and extremely so in some other fluids. It is endothermic, giving 407 calories per cubic foot, whereas theoretically its value is 336·5 calories. As an illuminant it gives the most brilliant light of all gases, 5 cubic feet per hour under suitable conditions giving 240 candle power. For small consumptions, however, this value is not obtained, and ordinary burners after a short time become clogged with soot. The latter defect can be overcome by the use of an injector burner, which, however, requires a higher pressure. Various diluents have been suggested, but have not been tried on a practical scale. The flame has a high actinic value, and causes light colors to appear lighter and dark colors darker than when exposed to sunlight. The gas, when inhaled, combines with the hemoglobin and renders the blood incapable of taking up oxygen, and thus causes suffocation. It has, however, been shown that it is no more dangerous in this respect than coal gas.

Acetylene unites with copper, in the presence of moisture and ammonia, forming copper acetylide, and this when in a dry state is violently explosive. Silver is similarly acted upon.

Owing to the difficulty of obtaining the materials used in producing calcium carbide in a pure state, phosphureted and sulphureted hydrogen and ammonia are often found in the gas, and these should be removed by passing the gas through water and an acidified solution of a metallic salt. Nearly all proportions of air and acetylene are explosive, the gas itself being decomposed at 780° C. At higher pressures than 2 atmospheres, if this temperature is attained by a part of the gas, it is communicated throughout the whole mass and a violent explosion occurs, which causes the pressure to rise to eleven times the initial pressure; but owing to cooling by radiation, etc., this is not reached in practice. Acetylene can be readily liquefied, having a critical temperature of 37° C. and pressure of 68 atmospheres. The resulting liquid is very light and has a high coefficient of expansion. Although this is a convenient method of storing a large quantity of gas in small bulk, it is unsafe, because of the ease and violence with which it explodes. The gas is extremely soluble in acetone; it has been suggested that this property might be used for its storage, but it has been shown that acetylene does not, even when thus dissolved, lose all its explosive properties.

Numberless devices for generating acetylene have been invented; its application, however, is more dependent upon the cost than upon the apparatus used in the manufacture. With calcium carbide at £16 per ton, it can compete with coal gas at 2s. 6d. per thousand cubic feet, when flat flames are used for the latter, and a light of not less than 30 candles is required. This renders the gas peculiarly suited for buildings in which coal gas is not obtainable. It has been used for lighting a station on the Great Southern and Western Railway of Ireland and at the Salford Docks of the Manchester Ship Canal. In the latter case, special portable generators are used which can be carried to any part of the docks, and which may be placed on the quay side and the gas led away to lamps placed in the holds of vessels. Among many other uses suggested are the lighting of lighthouses, lightships, buoys, military signals, etc., as a standard of light, etc. The price prevents its use for gas engine driving. This reason also prohibits its use as an enricher of coal gas, as with low percentages the increase is not above 1 candle power for 1 per cent. of acetylene. With "blue" water gas it is even less applicable, as more than 10 per cent. is required before an illumination is obtained. Methane and nitrogen are claimed to carry the gas without affecting its illuminating power.

ADMIRAL PASCUAL CERVERA Y TOPETE.

* The article was written some weeks before Mr. Gladstone died.—ED.

A NEW FORM OF TABLE KNIFE.

THE principal cause of stomach troubles is due to insufficient mastication of the food eaten. The result is a defective alimentation, whence an extension of the stomach, with supervening gastralgia, gastritis, etc.

All this might be avoided by a division of the food, meat especially, into very small pieces. In order to effect this operation, it suffices to employ the new form of table knife invented by Mr. G. Bay, and which consists of four blades united in a polished metal or ivory handle. These blades may be separated without the use of any tool, and thus be cleaned or polished with ease.

In order to use this instrument, the meat is first cut into five or six mouthfuls, and then, each piece being held by a fork, two cross cuts with the new knife divide

FIG. 1.—METHOD OF USING THE KNIFE.

it into bits so small that they might, without inconvenience, be swallowed without being chewed.

The accompanying figures, from La Vie Scientifique, show the knife and the method of using it.

THE PATHOLOGIC IMPULSE TO DRINK.

By WILLIAM LEE HOWARD, M.D., Baltimore, Md.

IT is to be understood at the commencement that in the present paper the conditions I consider are not to be confounded with those of the common drunkard, the chronic alcoholic, or those found existing in individuals with defective moral sense or continuous unstable mental equilibrium. I shall study in this paper the unfortunate individuals suffering from a pathologic impulse to drink regardless of all effects or results—an impulse considered by many alienists a periodic insanity.

The primary condition of the dipsomaniac is not caused by alcohol. The starting point is a pathologic one; the impulse, the insatiate desire to drink, is due to this pathologic obsession — this paroxysm which has come over an otherwise lucid mind. A clinical picture of one of these dipsomaniacs will enable us to better understand the morbid states which we are to study. A man, with wife and children, holding a responsible position, upright and honest in his daily life, shunning coarse companions and avoiding drinking places, educated, refined and domestic in his habits, who suddenly shows a disposition the very antithesis of his daily life, and after a short interval of abnormal existence returns to his quondam habits, offers an interesting psychologic and pathologic study. The sudden desire, the irresistible impulse, to drink enormous quantities of liquor, concomitant with palsy of the will and moral obmutescence, is rightly called dipsomania.

A few days before the irresistible, savage, maddening, overpowering impulse to drink exerts its full force the individual is restless, irritable, suffers from insomnia, or, should he sleep, is disturbed by mild but uncomfortable dreams. Slight muscular tremors may be noticed, and every act is accompanied by an uncertain or impulsive movement, physical as well as mental, showing that though up to this time no alcohol has been taken, and none perhaps for months or years, there exists a slight erethism of the cortex. The struggle, the painful demand for alcohol, the determination to control the crying yearning for some relief from this horrible restlessness, the knowledge of the fact that the higher centers are so disturbed as to make the carrying out of daily duties impossible, are too fearful for even a person perfectly conscious of the ultimate disastrous results to stand against. One drink only will he take to relieve the distressing restlessness. He steps into a saloon, an act which a few days ago he would have considered degrading. The one drink is taken, after which there does not appear to be any limit to the amount of alcohol he is capable of consuming. His thirst is savage, uncontrollable, unlimited. Now hours pass as minutes. The individual becomes voluble, boasting, egotistic and self-contented; he delivers philippics and enters into polemical discussion with his bar room companions, considering himself an oracle, the center of every movement. The amount of alcohol imbibed does not affect the motor or sensory centers to any marked extent, but the higher centers are completely in abeyance. No food is taken, and as midnight comes he departs with his newly made acquaintances to some low, disreputable all-night hole which is like a palace to him, the parasites being his willing knights. A short doze on a dirty sofa, and the morning will find him without the physical or mental energy to leave the rum hole; and humored, flattered, cajoled and contented, he will remain in this lycanthropic condition, dirty, filthy and regardless of his personal appearance, until the nerve storm has spent all its fury. This storm, which approached with its undulations of fast-gathering tumults, its psychic murmurs, its sighing, its slow but insidious strength, finally bursts forth in all its horribleness and destructive fury, followed by rapid subsidence, leaving the hurtled flotsam, jetsam and moral wreckage to be gathered and dispersed by an interval of

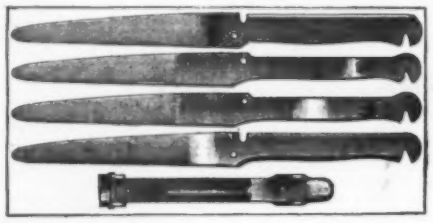


FIG. 3.—HANDLE AND BLADES SEPARATED FOR THE CLEANING OF THE BAY TABLE KNIFE.

normal life. The duration of the storm from its first fitful gusts to its last sigh covers a variable period—generally about three weeks. During this interval but little food is taken, and that at irregular periods. The mental condition during this period is not the one of maudlin drunkenness, not the one of violent, inhuman, tigerlike brutality seen in alcoholic frenzy and pseudo-dipsomania, but one in which the speech is tenuous, light, airy and teeming with idle gasconade. The ideas expressed are weedy, sedgy, spumy. There seems to be only a slight clouding of the mind as regards surrounding details; the whole mental condition and attitude is in fitting with his companions and environment. He has not the drowsy, sleepy stare of the drunkard; nor does he have the appearance of being insulated in the gloomy umbrage of alcohol. Regarding his true life, his normal condition, there is a hazy, vague state of intellect, if his attention is called to it; sometimes total oblivion of his duties and responsibilities. The return to his former self is comparatively rapid, and after the recrudescence he will have but a slight recollection of the length of time passed or the places where he has been. Often close questioning and leading questions will throw a ray of light on some obscure act, but even then he is not fully convinced that the fact is not some phantasm, some dream or idle banter of his questioner. He desires no liquor now, and has neither thought nor idea of ever wishing for a drop of alcohol. It is not the moral determination of the drunkard never to drink again, not the sickening, repulsive, abhorrent feeling of the inebriate for alcohol due to temporary excess, but a condition of psychical contentment. Such is a general outline of this pathologic condition which is demonstrated by the craving for drink.

There are naturally many various minor phases of this condition, may clinical units, but they can all be reduced to the same psychical elements. This craze for drink must not be considered a distinct disease, but as a secondary symptomatic condition, as are other impulses in abnormal mental disturbances. Although one attack of dipsomania is generally followed by another, such is not always the case.

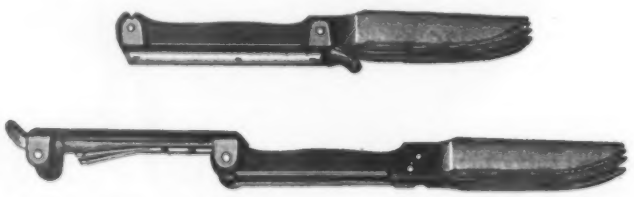


FIG. 2.—THE BAY TABLE KNIFE FOR HASHING FOOD.

I have had many opportunities to study these cases throughout their course, having had them under close observation from the prodromic period to convalescence, during which no liquor in any form was given. These cases exhibit a mental disorder characterized by great depression, anxiety and restlessness; inability to apply themselves to the simplest reading or games, an indefinable horror of some impending danger, and disco-ordinated psychic faculties. They soon become indolent and apathetic, though keeping up an incessant walk around the room and a conversation consisting mostly of lamentations regarding their inability to ever return to their business or profession. Insomnia is persistent, and anorexia so pronounced that often the taste of food will bring on an attack of vomiting. There is often spasmodic gulping down of food, and unsuccessful attempts to swallow, exhibiting an aura as characteristic as the epileptic aura. Frequently the sensation of precordial anxiety will be observed. In a day or so comes the impulsive, uncontrollable desire for drink. Large draughts of water are taken—hot one minute and a vehement demand for cold the next. The relief is only temporary, and soon the demand for alcohol asserts itself in pleading, cursing and argumentation, sometimes ending in a frenzy, the delire emotif of Morel. During this period, which will last several days, the throat is parched, the skin hot and dry. The pulse varies from 85 to 100. Although large quantities of water are consumed, comparatively little urine is voided and that is heavily charged with phosphates. At the height of the attack there is a passionate, desperate demand for alcohol—alcohol in any form. They plead, clamor, pray and struggle until, exhausted, they sink into a temporary consciousness of the impotency of their will and mental demoralization. This condition lasts for a short time, when the craze for alcohol again commences. With the subsidence of the cortical irritation comes great physical weakness and moral depression, or the oppression of inexpiable guilt, apparently much greater than in the cases which have succumbed to the passionate demand for alcohol. In fact, the latter cases recover their physical health in a few days; the former suffer from weakness and mental depression for some weeks after. This mental depression is probably due to a bitter recollection of the sad state they have been in and the fear and anxiety of future attacks (melancolie impulsive ou anxieuse).

The cases which yield to the impulsive demand for alcohol are little troubled by introspection, as the alcohol has paralyzed the higher centers, and the memory of events is too vague and hazy to give these individuals those afflicting, dismal thoughts which cause so great apprehensiveness to the cases which go through the attacks without obtaining alcohol. The cases under strict surveillance and not allowed to have any alcohol last much longer than do those who exhaust themselves by excesses. In these latter cases the abatement of the cortical irritation takes place more rapidly. There is no demand, desire or physiologic craving for alcohol in these subjects when the nerve storm is over. Alcohol in any form is repugnant to them—a radical difference from the inebriate or drunkard. There are few, if any, symptoms of alcoholism.

Of all the phenomena of which the life of the neurotic is replete, this one of dipsomania requires conscientious study by the medical profession. It is not an isolated phenomenon, but a syndrome. Its force, fury, sudden onslaught and periodicity demonstrate that we are dealing with a mental disturbance. For the sake of humanity, science and sociology we should do our utmost to bring it out from the dark chaos in which it is confounded with vicious habits and drunkenness, and place it among those psychoses which the science of medicine studies and treats as mental and nervous diseases.

Too great importance has been attached to the alcohol habit in connection with dipsomania. Alcoholism never leads to true dipsomania, although alcoholism and pseudo-dipsomania are allied, and the error has arisen in confounding the latter with dipsomania. The line between the drunkard and the pseudo-dipsomaniac is not an incised one, the conditions being those of correlation. The pseudo-dipsomaniac is an intermittent drunkard. He will drink to excess whenever opportunity occurs, and at no time does he have the repugnance for or fear of alcohol which possesses the dipsomaniac during his lucid intervals. The pseudo-dipsomaniac will enjoy an opportunity to drink to excess, but ceases with the opportunity. The dipsomaniac knows no halt, no restriction; he must, he will, he does, succumb to the impulse to drink to the extent of causing total oblivion of all honor, respect and fealty due himself, and all duties, obligations and responsibilities due others.

It was this confounding of dipsomania with pseudo-dipsomania that caused Hutcheson, Bucknill, Hack, Tuke and others to divide dipsomania into several varieties.

That which distinguishes dipsomania from various alcoholic habits and conditions is the impulse. Its periodicity causes Kraft-Ebing to consider it a periodical insanity, a variety of hereditary alienation. Magnan admits that the impulse is a syndrome met with in individuals with a hereditary incubus (les syndromes de la folie des hereditaires).

It is evident from what has been said that the victim of dipsomania is born with defective mental equilibrium; that this unstableness is a profound one, and increases from infancy to full growth, and exists throughout the life of the individual.

Rabid impulsiveness is a phenomenon demonstrating peculiar mental states. This impulsiveness may take various forms and phases, but, whatever its form, it diminishes organic and psychic resistance.—Medicine.

In the Connecticut town of South Norwalk it became necessary a few months ago to construct a road to the depot on account of recent alterations made by the railroad company in its tracks, says The Engineering and Mining Journal. In making the surveys it was found that the best line for the new road passed through a factory site. In due course the owners of the factory were informed, a price was awarded for the property, it was condemned, and arrangements were made to remove the building in the way. At the time the exact line was marked out it was found that the said line would pass through a pair of boilers set in brickwork at that point. The owners of the factory desired to move the boilers, but the city council demurred, claiming that, as the city was to pay for the part of the land where part of the boilers stood, it was entitled to that much of the value of the boilers. The owners said they owned all the boilers. The city offered them $200, which was refused. Finding that the matter could not be decided in any other way, an adjustment was suggested, the line was marked out, and the boilers and setting were sawed in twain upon the line of survey. The part of the boilers and setting on the side toward the new road was held by the city, and the part upon the other side is retained in its original position by the owners of the factory. This is one of the most curious cases of childish stubbornness which could well be conceived, as no one gained anything. The owners of the property have parts of two useless boilers. The city has the other parts, and the city paid $200 to have them cut in two.

EULOPHIELLA PEETERSIANA.

IT is to Sir Trevor Lawrence, Bart., that we owe the privilege of publishing an engraving of this remarkable orchid, says The Gardeners' Chronicle. The stem, in Sir Trevor's plant, curves and twines among the branches of trees like a snake. The leaves are from 2 feet 5 inches to 3 feet 10 inches in length. The racemose flowers are borne on a scape, which grows more than a yard in height before the flowers are produced. Each flower measures about 3½ inches across, the sepals being bright purple with a very intense purple blotch at the tips; the petals are purple, not blotched. The lip is white with a broad purple outer border, with four erect vertical crests. The throat is white, streaked with orange.

AMERICAN COMPETITION WITH FRANCE IN AGRICULTURAL PRODUCTS.

FROM A FRENCH POINT OF VIEW.

WHEN the words "American competition" are uttered in France they seem to evoke a frightful specter. The cry is: "The grain of the Far West is the cause of all our trouble. The low-priced cereals of the United States are glutting our markets, ruining our farmers, impoverishing our landlords and causing a terrible agricultural crisis."

Well, this is all an exaggeration. The American competition that people are forever talking about, because they think they know more about that than any other, is not alone responsible for the fall in the price of agricultural products, and especially for the drop in wheat. Are the United States alone, in fact, capable of placing upon the markets of the world the millions of bushels that can cause the market price to decline? By no manner of means. Let one cast his eyes upon the following table, which shows the exportation figures for the great wheat-producing countries of the world:

EXPORTATION IN MILLIONS OF BUSHELS FOR THE YEAR 1895.

Russia	90·5
Hungary	28·5
Roumania	28·5
Turkey	7·1
Bulgaria	12·0
Servia	2·25
United States	66·5
Canada	12·0
English Indies	9·5
Africa	9·5
	266·35

EULOPHIELLA PEETERSIANA, FLOWERING FOR THE FIRST TIME IN EUROPE IN THE GARDEN OF SIR TREVOR LAWRENCE, BART.

Flowers deep bright purple; lip white, blotched with purple.

In the total of the exports those of the United States figure but a quarter. Perhaps someone will tell us that such proportion sometimes reaches a third. That is possible; but it remains none the less demonstrated that the American competition does not alone exert an influence upon the market price. The entire world is at present putting forth efforts to develop agricultural production in all its forms. And what remedy is recommended to the agriculturists of the old countries which the decline in prices is justly dismaying? "Increase your output," is the cry from every quarter; "produce more upon the same surface!" This is equivalent to saying: Still further increase the amount of your production! Under such conditions, is not a decline in prices easily foreseen, and, so to speak, inevitable?

It may even be said that all the progress made is tending to this end. The application of scientific discoveries, the improvement in mechanical agricultural implements, the multiplication of ways of communication, the decline in the cost of transportation by land and water, and, in a word, all the transformations upon which man rightly prides himself, have for a definitive, desired and anticipated result a reduction in the cost of production, and, as a consequence, a decline in prices.

The Americans themselves are the first victims of such decline. There is nothing easier than to calculate the loss that they have sustained. Thus, we know the value of their exports of wheat. Let us see what they would have been if the price had not fallen since 1872. The difference is equal to the profit of which they have been deprived or to the sudden loss. Mr. Powers, the manager of the Labor Bureau at St. Paul, has shown us the results of his calculations, which are curious:

LOSSES SUFFERED, IN TAKING AS A POINT OF COMPARISON THE MARKET PRICE OF WHEAT IN THE PERIOD 1869–1872.

Years.	
1884	$7,000,000
1885	36,000,000
1886	34,000,000
1887	37,000,000
1888	33,000,000
1889	11,000,000
1890	33,000,000
1891	21,000,000
1892	23,000,000
1893	64,000,000
1894	76,000,000
1895	80,000,000
1896	59,000,000

During the last three years the loss of which we speak exceeds $200,000,000. Now the decline in prices does not affect wheat only, but extends to other cereals, to cattle, to dairy products, etc. In representing the mean value of all agricultural commodities during the period 1871–74 by 100, we find that the average prices in the Eastern States are represented by:

Periods.	Price.
1871–74	100
1875–78	85
1879–82	96
1883–86	97
1887–90	92
1891–94	83

It is clear that the decline touches all products in various proportions. It is a curious thing that the agricultural crisis affects the settlers of the Far West less grievously than it does the people of the Eastern States. In the West, in fact, the development of railroads, the facilities of communication and the decline in the cost of carriage have tended to raise market prices instead of depressing them. The leveling of prices has been favorable to farmers up to recent years. The market prices of cereals and cattle in the center of the fields of the West have not undergone the decline noticed elsewhere. This very remarkable economic phenomenon has evidently given an impetus to colonization. For the last two or three years, however, it is a decline again that has prevailed, and the accidental rise that has been caused this very year by a failure of the wheat crop in Europe has been hailed with enthusiasm by the farming population of the Far West. At the time at which we passed through Minnesota and the two Dakotas the price of wheat had just risen with wonderful rapidity. In the space of three weeks the market price had risen to a dollar a bushel. So the newspapers of the region celebrated the event in enthusiastic articles headed "The Marriage of Mr. Wheat with Miss Dollar." This union, so much desired, but impatiently awaited for a long time, filled the hearts of farmers with joy before filling their pockets with sound dollars.

Unfortunately it is very probable that a divorce will be pronounced in a few months, and no one knows when Mr. Wheat will again celebrate his union with the fickle Miss Dollar.

The Americans keep themselves well informed as to the economic situation of the universal market for cereals and expect to see a decline. In order to attenuate the effects of this, they of the East have intelligently utilized the capabilities of their soil and rapidly developed the dairy industry. In the West, an analogous transformation is in progress, and an endeavor is making to vary the cultures in giving preference to such as pay better than wheat.

In measure as the means of transportation multiply, cattle raising becomes possible and lucrative. Corn is no longer sold at a low figure as an export cereal. Its stalks and grain are employed as food for cattle and swine. Corn, thus converted into meat or milk, therefore acquires a higher value, and the agricultural crisis is attenuated.

One little known circumstance likewise corrects the effects of the development of the American rural production, tends to limit the decline in prices and assures an ever increasing output to agricultural commodities. Not only is the population of the United States increasing with extraordinary rapidity, but the agricultural element is representing a smaller and smaller fraction of it. The United States have become an industrial nation. The number of workmen in manufactories and that of tradesmen and their help has likewise increased more rapidly still than the farming population, and the latter has to provide for the needs of an increasing number of consumers. In 1870, out of a total population of 38,500,000 persons, there were reckoned 5,500,000 farm hands of the male sex, say 14 per cent. In 1895 the population rose to 69,700,000, but the number of agricultural laborers did not exceed 8,200,000, say a little more than 11 per cent. The proportion is therefore visibly decreasing.

This fact explains at the same time the rise in the price of agricultural hand labor in the United States. The wages of laborers or domestics are in most cases double those paid in France. There is here no doubt an obstacle to the development of industrial cultures such as they are practiced in our country. In order to triumph over this difficulty, the Western American farmer raises his own cattle and works with his own hands, aided by those of his children.

At all events, it is certain that the fall in the price of farm products has not had a reduction of wages as a consequence. On the contrary, the latter have increased during the last ten years. In the United States, as in France, the agricultural crisis has seriously affected only the landlords and the growers, that is to say, those who employ laborers and domestics. At an epoch when it is the fashion to talk about the poor man being taken advantage of by the capitalist, such facts are worthy of being dwelt upon. They give the ardent adversaries of our social organization the direct lie.

Among the interesting facts that we noted on our trip and were able to study with care, there is one upon which we must expatiate. The Americans do not profess the contempt that many Frenchmen have for "theory." That is to say, for scientific researches and the applications of the discoveries of science to the farming industry. They have even so well comprehended the importance of such researches and the economic range of such applications that for the last twenty-five or thirty years they have been founding agricultural colleges and scientific laboratories in all parts of their immense territory. We shall speak briefly of both.

The majority of the large American universities, like those of Yale and Harvard, possess chairs of agriculture. The students who wish to complete their studies in these magnificent establishments have at their disposal every resource that they could desire, such as laboratories, collections and libraries. It is scarcely necessary to say that the staff of instructors in these universities is of the highest order.

At the Cornell University in the State of New York, it is not only chairs of agriculture and the natural sciences that have been founded, but a genuine agricultural college admirably equipped and provided with a domain serving as an experimental field. This fine establishment is located upon a hill overlooking Cayuga Lake, one of the most picturesque sites that we

observed in the United States. The buildings, land, etc., occupy an area of over two hundred acres. An electric railway puts the university in communication with the city of Ithaca. The students who do not reside in this city live either in the college buildings or in handsome cottages built at their own expense and called fraternities. The course of study lasts from two to three years, according as the students wish to obtain the degree of bachelor or doctor of sciences. The subjects taught relate to agriculture, properly so called, to zootechny, veterinary art, physics, general and agricultural chemistry, mechanics, mathematics, botany, horticulture, entomology, political economy, English literature and to the French or German language. The students are exercised in the handling of instruments and in the manufacture of butter, cheese, etc.

Independently of the ordinary students admitted after an examination, there are others who pursue but a partial course for one or two years only. These young people are the sons of farmers who are unable to stand the expense of a prolonged course of study.

Finally, there have been organized winter courses, which are essentially technical and practical and designed to give students brief instruction in what concerns milk and its preparations, the feeding and care of cattle, the operation of dairy apparatus, steam engines, etc. Such courses last but three months. They begin in January and end in April.

Finally, let us add that the university is open to young women as well as to young men. The two sexes sometimes pursue the same courses and take part in the same work, especially dairy work, and no one thinks of being astonished at such fellowship. The number of female students in the American universities is, moreover, very large. The pride of the fair sex is nettled at the thought that man might become her superior, and the young ladies put forth every effort to resemble their rivals.

The organization of the agricultural college of Cornell University is nearly the same as that of the numerous special institutions that are found in all the States of the American republic. A federal enactment of 1862 richly endowed them by granting gratuitously to each of them over 24,000 acres of public land. The revenue from this princely appanage has been increased since 1890 by an annual endowment of $15,000. Add to this some gifts and legacies by private individuals and the grants of the States themselves, and one will have an idea of the extent of the resources that these establishments have at their disposal. In addition to these agricultural colleges, we find in every State experimental stations either isolated or annexed to an establishment of instruction. The laboratories of these stations are directed by botanists, chemists, entomologists or agriculturists. Here is studied everything relating to fertilizers, seeds and the food proper for cattle, etc. The laboratories are perfectly equipped and are in the receipt of a revenue that would be envied by many of our provincial faculties.

Finally, in Washington itself the Department of Agriculture possesses a number of laboratories and special bureaus under the direction of men of the highest talent whose name is an authority in their particular branch of study.

In addition to this public organization, the role of which is very important, there must be mentioned hundreds of private agricultural societies that are rendering the most useful service. They organize exhibitions and competitions and bring together farmers, and also give advice to the latter through special bulletins.

The agricultural press itself is rendering signal service. Agricultural journals are widely read in the United States and the number of copies circulated is something enormous. These are characteristic traits that reveal to us what may be called the state of the pulse of the American public.

In France we are unable to comprehend what agricultural industry and the immense range of its development really is. People are scarcely interested in it, and it seems to be thought that one lowers himself when he becomes a farmer. Such ridiculous prejudice as this does not exist in the United States—D. Zolla, in L'Illustration.

THE LATEST DISCOVERIES AS TO THE ANTIQUITY OF MAN.*

ALL modern geologists and anthropologists have extended the limit of the period of man's residence upon the surface of the earth from 6,000 years (as we used to be taught within my memory) to easily 60,000 years, or four times that number. In fact, we may say that man has lived upon the surface of the globe anywhere from 50,000 to 250,000 years. The geologists will give us willingly that limit to go by, and we certainly need the lesser limit of the two. We cannot possibly explain from any other point of view the diversity of races which exist among men, except on the ground and by the assumption of his long residence upon this globe—running back into at least 30,000 to 50,000 years.

When we undertake to define rather more closely than in these round numbers when and where he appeared and how long he has there existed, we are thrown back upon geological records. It would be quite impossible to find any history of man or even any records of his existence here through language or tradition or any such means. We must treat man as we treat one of the animals which have become extinct. We must find out where his bones are, and, in the case of man, where the relics of his culture exist, in what geologic strata; and, by defining the relationship between these strata, we can get approximately at the time he has lived upon the globe.

We have, fortunately, one measure of time which is of very great value in this connection. Some thousands of years ago there occurred, both in the northern and in the southern hemisphere and in the eastern and the western of the great continents, a very cold winter. Cold winters are generally remembered very strongly by the mind of man, and in this instance by the world itself; but this winter was of unprecedented length as well as of unprecedented coldness. It lasted probably many thousands of years. It was so cold that the whole of the northern hemisphere was covered with an ice mass of from 1,000 to 6,000 feet in thickness quite as far south in our country as the Kentucky River; in England, as far south as the Thames; and on the Continent of Europe very nearly to the Alps.

If man was anywhere on the globe, where was he then? We have strong reason for believing that certainly in Europe he was about the edge of that glacier. We have very positive evidence that about that time he was making stone implements in the caves just on the edge of the glacier; but when we come to examine closely into the relation of those remains, we meet another geological question: Was this cold winter of the great ice age or the glacial epoch continuous? Did it start in, let us say, at such a date and continue to another date, and then did the ice melt and the warm weather come again? Apparently not. It would seem that at various times this great glacier melted and the ice wall receded indefinitely far to the north; and then another cold spell came on and the ice barrier advanced toward the south, and, perhaps, again receded.

Between those periods of great cold were the interglacial periods, and they come in a very important manner into this question. We must ask ourselves, Did that cold winter come only at the time of man's presence on this globe, or did it depend upon some great cosmical change (such as the relationship which the axis of the earth bears to the plane of the ecliptic), which is apt to occur once in a while throughout the whole history of the solar system? Both theories have been advanced: the one that the change was cosmical in its action and, therefore, had been repeated from time to time indefinitely in the past. The other that such is not the case, that there is really no evidence of that cosmical change of the earth's axis, but that that great cold was brought about simply by a distribution of land and water on the surface of the globe; and from the evidence which has been brought forward on both sides, I, not as a geologist, but as a student of the matter, would think it much more likely that it was owing to the physical geography of the land and water areas; in other words, that if to-day we could have the land so distributed in relation to the water of the globe, we should have again that glacial epoch, with just as great cold as then existed.

In connection with this great glacial and interglacial period we do find the bones of man, his stone implements and those made of horn and bone. The effort has been made recently by some students of this subject to divide these remains into the pre-glacial, the interglacial and the post-glacial. You will observe that is a very important distinction.

Tertiary	Pliocene			
Quaternary	Pleistocene	Pre-glacial		
		Glacial	First interglacial	Diluvial
			Second "	
			Third "	
	Post-Pleistocene	Post-glacial		
	Present			Alluvial

The oldest of the deposits sketched above are the tertiary Pliocene. Some writers and teachers say that there are remains of man in the tertiary Pliocene—that long ago. For myself, I have never seen any evidence that convinced me that we have a right to say so; and I do not count any such evidence in; but when we come to the later development of the history of the globe in the quaternary time (that in which we live), we do find remains which very competent geologists have placed at its very beginning, which is in the Pleistocene. We have the quaternary divided by some geologists into the Pleistocene, the Post-Pleistocene and the present. The Pleistocene and the Post-Pleistocene include the various glacial phenomena—the preglacial, the real glacial, with its various interglacial divisions, and the post-glacial; whereas the present period is concerned with the alluvial deposits of our known river valleys. There are a great many other divisions of this quaternary epoch; every geologist, almost, makes his own, and I do not offer this, therefore, as being the best of all, but for the purpose of this lecture it is as convenient as any. It uses well known terms, and will show you the relation between the alluvial (which is the most recent), the post-glacial (the next older), then the true glacial (divided into its various interglacials) and the pre-glacial. This more particularly applies to the continent of Europe, and it is from that, for reasons that I shall give later, that I shall bring most of my examples.

In pre-glacial time, apparently, the water was warmer than it is now. It was warmer then than it has been any time since in the north temperate and the south temperate zones. All that was probably dependent on the distribution of land and water on the surface of the globe. This will give you an understanding of the general relationship of the time of which I am going to speak. I will only add one point that has been brought up—a new difficulty that has been created for us—by some of those Germans who are always bringing out some novelty in science to overturn our thoroughly well established grounds of knowledge and belief. One of these Germans has asked, "What does interglacial mean?" He claims that interglacial can only be applied to a deposit between two terminal moraines; in other words, between the two lowest deposits of previous glaciers. That has upset a great many persons' theories as to interglacial man, but I believe that author in this instance was quite right, so far as accuracy of scientific observation was concerned; and it gives us a warning not to be hasty about deciding as to interglacial man.

Turning from this geological introduction, I will take up the question as to what and where we find the oldest human remains—what they are and where they are found. When we ask that from history or even prehistoric tradition and the oldest remains of civilization, all of you would say at once we find them in Assyria, Babylonia, the valley of the Euphrates, or we find them in Egypt or in western Asia or close to western Asia; yet it is true that the most careful researches in Babylonia and Assyria have not carried man there nearly so far back as they have carried him elsewhere. Prof. Hilprecht has had the daring to carry man back in Babylonia (in the excavations at Nipur and elsewhere) at least 7,000 years before the Christian era, and at that time man lived in the Babylonian Valley in a reasonably high state of civilization. For instance, he made excellent pottery and he knew the uses of several metals, but we do not find any evidence where that man lived previous to his living there; we do not know and we have found no evidence of what is called the old stone age—paleolithic man—anywhere on the Mesopotamian plain. That is true of Egypt; that venerable land, which used to be considered the cradle of civilization, culture and of humanity itself, has yielded, indeed, to the excavators of modern times remains and relics going back about the same time as those of Babylonia (say 7,000 B. C.), but not older. There have, indeed, been remains there which have been claimed by their finders to be paleolithic—to belong to man at the time before he even knew the art of boring and polishing stone. But when you come to examine those finds according to the criteria and measurements of accurate science, their value disappears. There is not a single one of those recently brought forward by De Morgan in his book of last year which will bear examination by the test that we American archæologists apply to those remains, and we are much the severest critics of all the scientific men in the world in those respects. We have not found anywhere—no evidence has been adduced to show—that paleolithic man lived in Egypt; and when we come to the venerable country of Syria, Palestine, the great holy city of the Jews and its neighborhood, the latest investigations that have been made there by Prof. Zumhofen, of the University of Beirut, have not revealed to us any remains of man in the caverns of Syria or Palestine older than the existing historic fauna; that is to say, that along with the bones and the ancient remains of man, the most ancient, are found the bones of the modern fauna, the modern animals, and none others; no extinct animals. We do not attribute any venerable age to any existing species of animal. When we find the remains of man intimately associated with extinct animals, then we may give to those remains an age of venerable antiquity indeed. This has not been the case anywhere in western Asia nor in the Nile Valley nor in northern Africa (though, to be sure, many portions of that large area have not yet been explored).

There has been an article passing through the journals in the last two years of the discovery of human remains—that is to say, flint implements—in Burma, going back to such an antiquity that we must reject it on that very ground, going back to the middle of the Miocene. That would be still older than the Pliocene or the tertiary; and I have felt compelled to reject it, along with most others. However, these remains have been criticised by an observer on the spot. They were first announced by Dr. Netling. The locality was subsequently examined by Mr. Oldham, an Englishman, who considered that the remains supposed to have been found in the Miocene were, in reality, in a very much more recent formation. The usual discussion ensued and each observer maintained the accuracy of his own observation; but inasmuch as the inherent improbability is very great against Dr. Netling's theory, it appears to me that it is not possible to accept it.

In fact, we must rule out as doubtful about all the statements that very ancient remains have been found in Asia or in northern Africa showing man previous to a time which we could call glacial. This somewhat reverses the opinion that we held in earlier years—that Asia should be looked upon as the cradle of the human race; and it may be that the reversal is temporary only—it may be that the court which will sit later on this subject will revise that finding and give a different judgment upon it; but I can only tell you the opinion which is held to-day by those who have given the subject most study, and that is distinctly to reject all the Asian finds of alleged great antiquity of man.

If we do not find these remains in Asia nor in North Africa (where history points to man's earliest dwelling), where should we look for them? Doubtless in Europe; and it is in Europe that we find, up to the present day, man's remains of the highest antiquity. Not in the north of Europe; Scandinavia nowhere shows man as existent previous to the era of polished stone; Russia shows nowhere any trace of truly ancient man, nor does North Germany; but when we come to Bohemia, there we do find some in the caverns of the Silesian Alps, as they are called; they have been carefully explored of late years, by Bohemian archæologists, particularly; and they have found not only man's remains in the shape of implements of stone, roughly hewn, but also some of his bones, and these bones indicate a condition of the human race somewhat different from our own. Bone has been discovered, an under jaw; at another time, a tooth; and these have been brought into relation with finds of a similar character discovered in the peat, the turf, near Weimar, in central Germany. One of the interesting finds of two or three years ago was that from a nine year old child, one of the last of the milk teeth. The peculiarity of this tooth was that it was striated, that is, that it had fine lines along it. These we do not find in the teeth of that age in the children of this age; but it may be a coincidence that we do find those lines in the chimpanzee and in some of the anthropoid apes of higher denomination. At any rate, we have discovered in central Germany and Bohemia remains of man that must be placed back some time in the glacial age. These caverns contain the bones of animals wholly extinct in historic time and belonging to a fauna which required a very much colder climate than those parts of Europe have had since history began. We may suppose, therefore, that the men of that day, living in those caves, were struggling against an inclement climate and were living near the edge of the great glacier.

This obtains support from the studies which have been made in the French caves and river bottoms. There is a rather curious contrast in the French earliest discoveries. You will find in the gravels which have been dug out of the River Somme, for agricultural and building purposes, bones of mammoths of three varieties, two of which needed a tropical climate; bones of hippopotamuses of various species; of monkeys; of the rhinoceros (the variety requiring a tropical climate). Along with these bones of animals extinct in that latitude we find any number of chipped stone implements: the number which has been estimated as discovered in the valley of the Somme alone is something like 20,000. They must have been deposited there through a long period of time. They are all of one character. We do not find there anything to indicate a higher civilization than that which was required to manufacture a rude stone implement. It would seem to be without any doubt that this indicates that man lived there along with those animals; that he lived there and at a time when the climate of the

* Lecture by Prof. Daniel G. Brinton before the Academy of Natural Sciences of Philadelphia.

place was almost tropical in character; and that could not have been at any time since the great glacial age began. Man therefore, in the valley of the Somme, and in various other parts of France, is distinctly pre-glacial, and that is also true as to the remains in County Kent, England, and along the Thames.

Sir Joseph Preswich, one of the very highest authorities in British geology, published some years ago the discovery of a number of chipped stone implements about the plateau of Kent, along ancient river bottoms which had been elevated now to become the ridges of the county. These excited a great deal of discussion—some claiming that these alleged remains were natural chipped stone; others again, granting that they did belong to the artifex of humanity, claimed that the deposit was not conclusively pre-glacial but was probably post-glacial. I do not know that the question has been absolutely decided. The British Association for the Advancement of Science appointed a committee (of which Sir John Evans was president) to go and examine these localities. They did so faithfully; but the members of the committee apparently disagreed among themselves, some maintaining the opinion of Sir Joseph Preswich, others doubting it. The majority of writers and students of considerable value, however, in their opinions agree with Sir Joseph Preswich.

The late president of the Anthropological Society of Great Britain, in his annual address of a year before last, devoted a considerable space to this very point; and his conclusion may be expressed in his own words to the following effect: "You will find," he says, "on the plateau of Kent, I will not say the oldest remains in existence of human activity, but remains as old as the oldest." By these words he meant to say that there may be found, or known, other localities with remains perhaps as old, as far as we can tell; but none the general surroundings of which prove an antiquity greater than in the valley of the Thames. This conclusion I believe is that generally adopted to-day in England by those who have studied the locality.

We have, therefore, this interesting conclusion to draw, that both in France and in England we find remains (to use his expression) as old as the oldest anywhere yet found on the surface of the globe; and it is deserving of reflection that just where we find these oldest remains of man we find his most dense population to-day and his highest advancement in culture, civilization and refinement, in and near the great cities of London and Paris.

At some distance and yet in the same area we discover in Spain—still again in the vicinity of one of its greatest cities, Madrid—gravels which have been deposited there time immemorial, certainly before the glacial period. There are there about 10,000 square miles of gravels deposited by fresh water agencies, in other words, by rivers now entirely dried up and which, at that time, must have flowed from a direction toward the northwest of Madrid and the high plateau surrounding it. That plateau is 3,000 feet in elevation, being an arid plain surrounded by mountains. For that river ever to have existed and to have poured forth a stream of water which carried with it those thousands of square miles of gravel, the whole configuration of the land in the northern hemisphere must have been different. Spain, instead of being 3,000 feet in elevation in its central plateau, must have been at the level of the sea, or a very little above it; and that river must have flowed over where the Bay of Biscay now covers sunken continents; yet in this gravel, so deposited by these rivers long since disappeared, we find the remains of man indubitably in the original deposit left by him at that time; we have rude stone implements very similar to those that we find in the valley of the Somme. We have a very fine example of such a stone implement in the Museum of the University of Pennsylvania, collected by Mr. Mercer, the present curator of American antiquities, obtained by him from the gravels near Madrid, being one of many that have been found there, but worthy of note for the great pains which he took to ascertain its exact location in the gravel, photographing it on the spot before and after it was taken out, and calling others to verify all his statements. This, therefore, carries us back to pre-glacial times.

The combination of the evidence in France, in England and in Spain appears to me conclusive. Now how far back would that be? The opinion of Sir Joseph Preswich (a careful man, a thorough geologist and very conservative) is "not less than 30,000 years would answer, but it would be between that and 50,000" that he would place the deposit which he examined on the plateau of Kent, he inclining to the higher number. That does not at all satisfy the French archæologists, especially Prof. Du Marquier, who has written extensively on this topic and has personally made many examinations of localities. He gives a long series of reasons, based upon the stratigraphic relations of these deposits and the disappearance of the fauna and the flora of the locality; upon the changes which must have taken place and the time required for those changes; and he places the time when man lived along that valley of the Somme and dropped these implements into its gravels at 240,000 or 250,000 years ago; and in his last work upon the subject, published in 1897, he reiterates this statement after fifteen years more of examination and confirms it in his own opinion. I do not know that further evidence can be offered than what he has collected, and it may therefore be assumed that man in western Europe has an antiquity of at least from 100,000 to 200,000 years. I learn of no other locality on the face of the globe where we can say definitely that there is so much evidence accumulated of the antiquity of man as there.

There are, to be sure, a number of other localities which should have our attention in this connection. There is a locality which is now under the water between England and the coast of Holland. It is off the shire of Norfolk, in England, on the North Sea. At some time comparatively recent the land there sank and carried with it vast forests. These are the forest beds of Chromer, as they are called. They certainly date anterior to the great convulsion of nature which took place at the time of the incoming glacier. These deposits have been very carefully studied by biologists and the fauna and flora in them distinctly assigned to pre-glacial conditions; but it was only within the last two years that a geologist found in these Chromer forest beds a number of chipped stones which he concluded to be of human origin. They have been exhibited and published and models of them made and sent abroad; and there is a certain difference of opinion about them as to whether they are really of human origin or whether they are merely the natural cleavage of the stone itself. They are of human origin for this reason, I believe: that while any one of them, taken by itself, could easily have been modified to that form by natural processes, yet there are so many of them that have a form closely alike as to render the improbability greater and greater that they could have been of natural origin. If this is the case, it is another corroborative point of evidence to what I have already said, that man in western Europe must in his beginnings be placed in pre glacial geological time.

I need not go in detail over these various finds that have been made in the last two years, in France especially. Every year, almost, they discover some new deposit which they call Shelleian implements, from the station of Shelley, where the finest deposits are discovered, as seen in the typical representations of these ancient paleolithic stone axes, handles and hand stones. A number have been found in the clay which underlies the glacial clays or post-glacial clays of the northern coast of France, in Normandy and Brittany. I, in the summer of 1896, had the opportunity to examine several hundred of them which had been discovered near Havre. There could be no doubt for me that they were of origin by the human hand; although rough, they were clearly shaped by human agency, nothing else could possibly have done it. They were found in this underlying clay, and the age of that clay is considered to be very early glacial or pre-glacial.

Still another evidence in the same direction, some have been found also in Italy; but there the uncertainty becomes greater. The claim that has been made that at various times in the Italian caverns the remains of man have been found dating to a pre-glacial time is, to a certain extent, invalidated by the fact that, when we cross the Alps, we can no longer talk about glacial time. The glacier did not affect any part of Europe south of the Alps or south or west of the Pyrenees. We do not find any signs of glacial action in Spain, or in the Iberian peninsula. The glacial action distinctly stopped (as far as striæ were concerned) north of the Thames; and we do not find distinct marks, either in Italy or in Spain, of that great change in the fauna and the flora which was brought about by the advancing ice wall; the great walls themselves, of the Alps on the one hand and the Pyrenees on the other, shut off the cold, in great measure, and allowed the climate to be comparatively mild, even in that extreme winter.

Therefore, in studying this particular question, we cannot go outside of France toward the south. The reindeer never crossed the Pyrenees, although he did graze in its valleys on the north side; nor did he ever enter the fertile lands and pleasant climate of Italy. Man, therefore, must have existed before the glacial appearance in Europe; if he existed before it, he must have existed during the glacier, because we find then that the inhabitants took refuge in caves, and all the cave remains which we find in Europe are not older than interglacial time. Man apparently did not live in caves in the pre-glacial period; there was probably no occasion for it. We find the interglacial cave man in many parts of Europe; we find him thoroughly well established on the upper Rhine, in northern Switzerland. He was by no means ignorant of arts. He was a very skillful man in chipping stone and making arrowheads and lanceheads, in making stone knives; he was also a good draughtsman, and he scratched with the point of one of these stone knives on the bone and horn of the reindeer, and throwing them away, those bones sank in the ashes of his hearth and have been preserved to the present day and are to be found—they or their copies—in all the museums of importance. Hence it is that we learn that man at that time, at the time of the interglacial cave life, had progressed far above any condition of pure savagery; that, again, demanded a long period of time and gives further evidence for our placing his ancestors back before the glacier began. Let us consider it settled, therefore, that in Europe, at least, man lived before the glacier.

What can we say of this new world of ours? A new world which may be (and geologically is, in many of its parts) the old world? When could man be supposed to have first come here; or did he originate here earlier than he did in the eastern hemisphere and move across? There have been many positive statements made on this subject within the last few years; and if we accept them all as they are given, we should have no doubt in saying that man lived here long before the glacier came upon the north and the south temperate zones.

Beginning with South America, we have had reported to us finds of man's hearths—of his bone and stone implements—in original deposits in the earth and clay of the lower strata of the pampas; and it is generally believed that the pampas of the Argentine Republic are a glacial, or an interglacial, or an immediately post-glacial deposit; and if we can find that man then lived, and lived freely and extensively at that time, when that lowest was being deposited, then we must suppose that he had been living there longer. These statements have been made by the official geologists of the Argentine Republic; but they have not been in a position where they could be examined and observed upon carefully by later writers; and within the last two years, if I can judge correctly by the reports that I have seen here, there and elsewhere in the journals, there has been a doubt cast upon these South American finds—a doubt arising from the fact that the few that have been re-examined have not turned out to be in the stratification required, doubt as to whether they belonged to the original stratification of the pampas, but rather to a later deposit.

In North America a number of examples have been brought forward. At the American Association for the Advancement of Science, two years ago, in Buffalo, Prof. Claypole, of Ohio, showed the section of anthropology a curious ax, polished, rude, made of the ribbon slate found out in Ohio. This stone ax was so weather-worn that it was stained almost to its core, rendered visible by the professor having sawed it in two and presenting both sides of it. This ax had been found in a well which a man was digging, at the depth of 22 feet below the surface, immediately above the bowlder clay of Ohio, in a glacial deposit which was covering the country to the extent of 20 to 30 feet in depth. While the appearance of the ax did indicate that it had been subject for a long while to water, yet the fact that it was so polished and rude was contrary to all that we know about the knowledge of arts held by man in pre-glacial or early glacial times. The history of the ax, however, materially militated against its antiquity; and archæologically it did not belong to the culture horizon of the glacial age.

We have found also (so it is stated) in the Ohio drift at various points in undisturbed glacial deposits near, or upon, or in the terminal moraine of the great glacier that stretched across the State, chipped stone implements, probably similar to those which were found also in France. They have been from time to time brought before public notice, but there has never been an entirely satisfactory statement as to the time, place and circumstance of the discovery. The only one which was discovered, within my knowledge, by a man who had a claim to a scientific reputation, was that of a former member of this academy, the late Dr. Cresson; but, owing to the fact that he did not leave behind him, in any of his papers, a specific statement as to how, where and when the ax which he discovered in the moraine was found, it cannot be considered of any value as scientific evidence to-day.

There have been published also, from time to time, other similar instances; but we must say that up to the present time the Ohio finds, though extremely attractive and most interesting in themselves, have not the authenticity which they require in order to make us believe in them wholly. There have been finds of similar character in California and in Texas; but I may pass over them by stating that in no single instance has one of these been proved satisfactorily to the scientific mind of the day.

As to the finds in the Trenton gravels, at Trenton, N. J., they have attracted probably more attention to this spot than any other finds of the character in America. They were first brought to the attention of the scientific world by Dr. Charles C. Abbott, of Trenton, about 1877. He found (so he stated) the remains of chipped implements, some skulls, some remains of the teeth of man, in the Trenton gravels at depths varying from one or two feet below the surface to forty feet, the latter resting upon the Jurassic deposit of clay used by the Trenton potters, which is secondary formation. Neither Prof. Leidy (who went up there a number of times) nor any of his pupils whom he took with him, nor Prof. Heilprin nor myself (who have passed fruitless hours there) ever found one of these in original situ. I have found them in the bank that goes down to the river, but I have never found it in the Trenton gravel; and yet that might have been merely an accident. The Bureau of Ethnology sent two experts there who stayed thirty days exploring, but never found one of them in the Trenton gravel. Prof. Putnam, of Harvard, found one there and other gentlemen have occasionally found single ones; but the celebrated finds in these deposits in the original Trenton gravels have now been rejected by all except those to whom I have referred.

They have been rejected uniformly in Washington circles and, I believe, in Philadelphia and New York circles; but within the last two years the case was changed. Less accent was placed upon the Trenton gravels, but it was said by Prof. Wright, the author of "The Culture Age in America," that there was a distinct layer of numerous implements, undoubtedly of human origin, in a sand layer above the Trenton gravels which immediately overlies it, and is of a depth of from one to four feet in thickness. But while Prof. Wright says distinctly that that sand layer is of glacial origin, the New Jersey official geologists regard it as of quite modern formation, as simply wind sand, which has been blown there at a time quite as recent as the alluvial deposits on the river bottom; and there is nothing extraordinary, therefore, that the Indians who were wading about in the alluvial bottom should walk about on the sand at the top of the bluff. Therefore this decision (which is one printed in the last six months over the authorities of some of the best geologists who have studied the subject) does away, I believe, with the last alleged positive evidence of glacial man at Trenton. It may be that new discoveries will enlighten us and lead us to change our opinion; but I am only giving you, in this lecture, the synopsis of the latest results (so far as I am aware of them) on this very important subject.

Up to the present we have no real evidence, from the field either of archæology or geology, that man existed in America during, or previous to, the glacial epoch.

PROTECTIVE VALUE OF MOTION.

MR. F. M. WEBSTER, in an address delivered before the Ohio Academy of Science and afterward published in The Journal of the New York Entomological Society* makes some interesting remarks on the protective value of action, volitional or otherwise, in "protective mimicry." After citing a number of remarkable cases more or less well known, he remarks, "Now in all these phenomena we have form and color supplemented by action, the object of all of which taken together is the protection of life." . . . . It was Mr. Bates who wrote in his "Naturalist on the Amazon" that "on the wing of the butterfly is written, as on a tablet, the story of the modification of the species, so truly do all the changes register themselves thereon," and it seems to me that in the brains of so-called "mimicking" species of insects we might, if we could but understand the full significance of the brain cells, read therein the records of the development of a dim, obscure consciousness, a volition and an intelligence that has kept pace in the requirements of these organizations in protecting their lives and perpetuating their race.

Man himself comes into the world little less than a mere automaton, but with an inherited basis for future developments of an individual consciousness, he begins his education with the alphabet, but does not transmit even a knowledge of this alphabet to his children, who must begin precisely where he himself began. But there has descended to his children that which will enable them to master the alphabet with more aptitude and less difficulty. Now if we descend the line of animal life until we reach these insects whose movements go far toward perfecting the protection afforded by their

* Journal of New York Ent. Soc., v. 67–77.

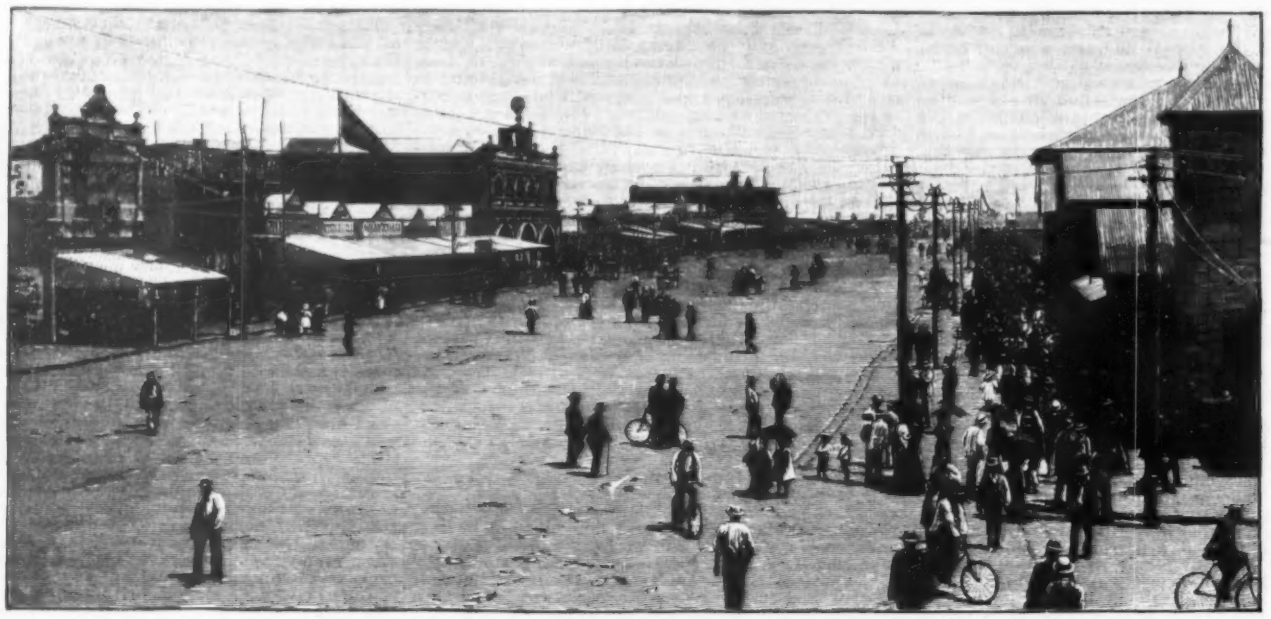
form, color and coloration, may we not expect to find the foundation for a "species consciousness" that will enable their possessors to protect their lives from enemies of long standing, and gradually, though perhaps very slowly, adapt themselves to shunning the attacks of more recent foes? Or, to put it in other words, with a protective appearance, will there not go either a consciousness of that appearance or an inherited foundation for such a consciousness that will better enable an insect to apply its protective inheritance, and in the use of all these as a means of perpetuating its kind, follow strictly in the line of all other animal life?

Among the most wonderful cases of "protective resemblance" noted was that of the moth Alaria florida, "which conceals itself during the day in the withering blossoms of the evening primrose, Cenothera biennis. The inner two-thirds of the wings of the moth are bright pink, while the outer third, hind wings and abdomen are pale yellow. The moth enters the flower before day with its body resting on the style, the four parted stigma projecting beyond the tip of the abdomen, appearing like a part thereof, and when the sun appears the two petals that were above the moth soon wilt and fall down over the roof-like wings, concealing the rose colored portion and leaving the yellow part exposed as a part of the blossom, and so effectually is the moth concealed in this way during the day that only a trained eye can detect its presence, and then only with extreme difficulty." The moth mentioned is very common in central New Hampshire, though it appears to be either very rare or unknown nearer the sea, and I have observed hundreds of specimens in the position described. The deception is certainly well carried out, though not in every case so fully as described by Mr. Webster, but the larva is even more closely concealed.

I had read that it was to be found feeding on the seed pods of the evening primrose, and had several times looked for it in vain, until one day I discovered a specimen in the act of backing out of the hole which they excavate in the pod, by gnawing a hole in the side and then eating the more juicy seeds. I broke off the whole stalk and was carrying it home when I noticed that there was a second caterpillar resting between the pods and resembling them so wonderfully both in shape and size as to escape my notice. I then began to examine the head more closely, and to my astonishment I found seven others resting in a similar manner. I thought I had seen them all then, but on looking in the breeding cage in which I had placed them, two or three days after, I found the stalk so wilted as to be unpalatable to the caterpillars, and no less than eleven were wandering around the sides of the cage. The other two were doubtless in the same position as those seen, but were overlooked even on close inspection. There is the possibility that they may have been in one of the hollowed pods, but it is not at all probable, as they would have had much difficulty in completely entering one.

THE GOLD FIELDS OF WESTERN AUSTRALIA.

THE position of pre-eminent importance which the gold fields of Western Australia occupy among the gold producing regions of the world, and the great future which the country still has before it, lead us to infer that a short illustrated description of these fields will be not unwelcome to our readers.



BAYLEY STREET IN THE WESTERN PORTION OF COOLGARDIE.

DRYBLOWERS IN THE VICINITY OF COOLGARDIE.

THE GOLD FIELDS OF WESTERN AUSTRALIA.

Before Arthur Bayley discovered gold in September, 1892, on the spot upon which the city of Coolgardie now stands, the local government officials of Southern Cross had reported all the region east of this latter insignificant mining center to be a great wilderness penetrated occasionally by the boldest explorers and inhabited by a race of a low order. As in every part of the world in which precious metals have been discovered, so here the discovery of gold enticed thousands hither, who, regardless of the great hardship and danger to be encountered, bravely pressed on into the unknown "bush." After the discovery of gold there arose near Bayley's own mine a mining camp consisting of tents and huts of the most primitive construction—the origin of the modern city of Coolgardie. Prospectors were constantly arriving in increasing numbers and the immediate vicinity of Coolgardie becoming too crowded and the unexplored "bush" of the interior presenting the possibility of further discoveries, bold pioneers set out toward the east, north and south, where many were richly rewarded. Thus it was that Coolgardie arose—even to-day the pearl of all mining districts in Western Australia; thus it was that Meuzier, Mount Margaret, Mount Malcolm and countless little places in the north were discovered; and also Kanowna, Bulong, Kurualpi, Black Flag, etc., in the east; Londonderry and Norseman in the south. The annual production of gold in Western Australia was, in 1886, 302 ounces; in 1891, 30,311 ounces; in 1896, 281,263 ounces; while during the first seven months of 1897, 451,041 ounces had been already obtained. Since the production was constantly increasing during the last six months of 1897, the yield for the whole year will probably be more than 150 per cent. greater than that of 1896.

The city of Coolgardie, which is laid out with wide streets intersecting one another at right angles, extends, with its suburbs, in which the homes of the well-to-do middle classes are situated, over more than four square English miles and has a population of 12,000. The main street of the town has been named "Bayley Street," after the discoverer of these gold fields. In spite of its recent construction, the city of Coolgardie can boast of some very sumptuous buildings of tolerably tasteful architectural style, which, however, cannot be said of the first public buildings erected in Coolgardie by the government in 1895.

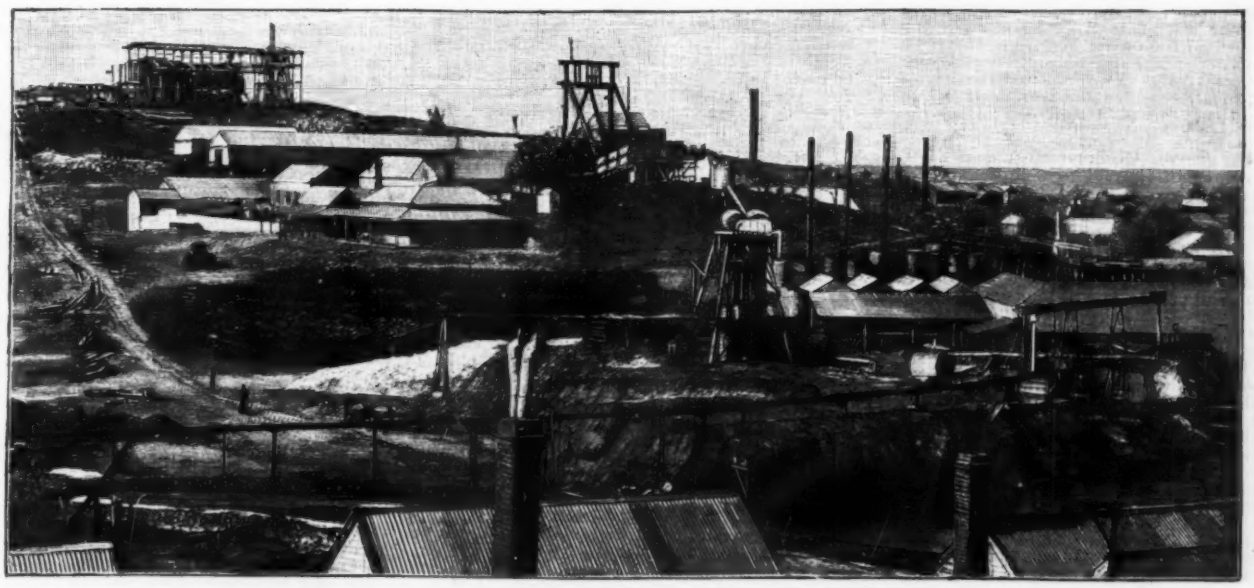
New discoveries of gold were soon made further in the bush: new cities and new mining camps arose and postal lines were opened to these places. Personal experience obtained by the author of this article while traveling over fifty miles of the so-called roads of Western Australia enables him to say that the mail coaches of these postal lines are the most agonizing instruments of torture with which he is acquainted.

At all important places the banks have established branches in which the gold obtained by the prospectors is deposited. When a large quantity of the metal has been collected, it is transported under the protection of mounted police to the main office at Coolgardie, thence to be carried to Perth or Melbourne. Goods, machinery, etc., are transported by various methods. Camel trains, heavily laden, travel with an impressively slow step over hundreds of miles of monotonous desert. The drivers and attendants of these camels are

usually Afghans. Heavy machinery, boilers, etc., must be transported by wagons drawn by horses, but even wagons to which camels have been harnessed are occasionally seen. For the extensive waterless tracts of the Western Australian "bush," the camel is extremely serviceable, and during the first years of discovery and exploration, proved of untold value to the prospector. Provided with a sufficient supply of water for himself, a gold digger could with camels travel entire days through waterless regions in which a horse would not have survived. Horses, moreover, required the additional transportation of fodder, and as in those days there was no railroad to Coolgardie, provisions were

A TEAM OF CAMELS.

ATTACKED BY SAVAGES.



THE LAKE VIEW MINE IN COOLGARDIE.

THE GOLD FIELDS OF WESTERN AUSTRALIA.

extremely costly. Camels, on the other hand, were amply nourished by bushes and shrubs. The long wished for railroad was formally opened by the governor, Sir Gerard Smith, on March 23, 1896. It was a day of rejoicing for Coolgardie, and the town could not help celebrating the occasion in true Australian fashion by drinking enormous quantities of champagne and whisky.

In the fields of Western Australia, alluvial gold cannot be obtained in the ordinary way by washing, for the simple reason that no water can be had. If I assure the reader that during the first years of discovery we occasionally paid 2s. 6d. for a gallon of water, it will be readily understood that the ordinary method of panning gold by washing was out of the question. In those days we could not even wash ourselves except on the most important occasions. In order to obtain alluvial gold a current of air is used, which is either naturally or artificially produced. The simplest method of panning gold is that in which two vessels are employed, one of which is placed on the ground; the other, full of quartz, is held with both arms as high as possible, imparting to it at the same time a motion of rotation. By this means the gold is collected at the bottom of the vessel, enabling the prospector to remove the upper layers by hand. The small mass that remains is collected on one side of the vessel, and the prospector then blows away with his mouth all the lighter particles of quartz that remain, leaving behind the heavy little lumps of metal. Large pieces of gold are, of course, detected beforehand and removed without blowing. There are also machines which, with the assistance of sieves placed over one another and whose meshes are of varying fineness, separate the coarse from the fine particles of quartz. Some machines, in addition to separating the particles of quartz, also blow a current of air. Prospectors who obtain the metal in this way are known as "dryblowers."

During the early years the blacks were a source of constant danger to the brave pioneers, and many a bold explorer succumbed to their spears, often hurled during some treacherous night attack. The prospector pictured in our illustration, busily engaged with his camels, hardly suspects that his last hour has come. But a change for the better has now come about; the natives have partly submitted to the laws of the whites and become civilized and have partly retreated still further into the wilderness.

The two largest mines in Coolgardie are the Great Bowlder mine and the Lake View mine. It can be justly asserted that the former has founded the reputation of Coolgardie and drawn the attention of the whole civilized world to Australian gold fields in general, and to this region in particular. Since 1875 the Great Bowlder mine has produced 42,481 tons of ore, yielding 145,202 ounces of gold, representing a total value of £58,000 sterling.—G. v. Reiche, in Illustrirte Zeitung.

Elastic Varnish.—Dr. Klein recommends a mixture of Peru balsam with nine times its weight of collodion as a suitable material for protecting small wounds. It forms an elastic and very adherent coating which is not removed by repeated washing.—Therapeut. Monatsch., 1897, p. 238.

ELECTRICAL NOTES.

In connection with the electric cabs in Paris, the following costs of various methods of locomotion, made by the Compagnie Generale, and published in The Practical Engineer, are instructive: Horse cab, 15 francs 44 cents. per day; petrol cab, 13 francs 20 cents. per day; electric cab (Krieger's), 8 francs 13 cents. per day. There is an economy of 47 per cent. over the horse and 32 per cent. over the oil motor.

According to a German contemporary, experiments with iron-nickel alloys have shown that different coefficients of expansion are obtained according to the percentages of the two metals. An alloy containing 45 per cent. of nickel has the same coefficient of expansion as platinum, and it is stated that this has been confirmed by experiments made at the Reichsanstalt. It is proposed to use this alloy to replace platinum in the manufacture of incandescent lamps.

In America a great deal of trouble is occasioned to central station engineers by arc lamps freezing up in sleet storms. Superintendent Camden was thus troubled until he hit upon the following device, which prevents the annoyance: He takes a number of thin sheets of cardboard and punches a hole in them the same size as the carbon, and, if the trimmer thinks that things are going to freeze, he slips one of these small pieces of cardboard on the upper carbon of the early side of the lamp. This acts as a shed for the water, and he finds very few cases where the lamp will freeze up where this has been used.

There are good prospects, says The Western Electrician, that another canal will be built to divert a portion of the water of the upper Niagara River from its natural course, to be used for power and other purposes. This time Lockport, Niagara County, N. Y., hopes to benefit by the project, and recently the contract was signed by the mayor and city clerk, on behalf of the city, and by the presidents of the Niagara, Ontario and Lockport Power Company and the Lockport Water and Electric Company, for a supply of 15,000,000 gallons of water daily for ten years, at an annual cost of $50,000. The canal must be finished and water ready for delivery by May 1, 1904, or the contract will be without effect.

In view of the fact that there are excellent telephones for divers' helmets, it is hard to explain or excuse the recent death of a diver at Key West, says The Electrical Engineer. It appears that Chief Gunner's Mate Johnson, of the gunboat "Newport," was asphyxiated recently while in a diving suit examining the ship's bottom. It was the usual quarterly examination. The air pumps were kept working regularly. The diver gave no signal to be hauled up. At last the tenders became alarmed and pulled him up. He was dead in his suit. The cause of the asphyxiation is not yet clear, but it is supposed that the air pipe fouled at the bottom, and was squeezed so as to cut off the supply of air. We may be wrong, but the mere tinkle of a bell from below, or the cry of distress to anyone listening at the telephone, would be sufficient to prevent such deaths, and the apparatus costs so little.

A novel use to which the telephone was put was related as follows in a recent number of The New York Sun, and is of interest as an electrical story, even if it is not true: "A Chicago man had a fox terrier of which he was very proud, and the dog was completely devoted to him. He had to go to some place in Michigan on business which kept him away for several days. As soon as he had gone the dog began to suffer from a severe attack of loneliness. He would not eat, and lay about moping until the man's wife was afraid the terrier would die before his master's return. One night the man went into the station of the town where he was stopping and said that he wanted to talk to his dog. So connection was made with his house and the receiver was placed to the terrier's ear. Instantly he recognized his master's voice and began to frolic about and bark at a great rate. Two or three times after that the Chicago man repeated the performance, and he did not mind the $10 or $12 that it cost him in the least."

The United States Naval Observatory is situated on Georgetown Heights, in the suburbs of the city of Washington, on a spot selected by a commission appointed for the purpose. The purchase of this site, which is irregular in shape, and contains nearly seventy acres, was made in 1882. One of the principal requirements of the commission was a site which should probably remain free from disturbances due to the proximity of a city and the effects of traffic. The electric railway had not then been perfected, and no more desirable site could have been selected. Three Kew instruments and one Mascart vertical force needle were mounted in January, 1894. There are two lines of electric railway passing on parallel lines in a northwesterly direction on either side of the observatory grounds. The main line passes within 1,400 feet of the magnetic observatory. The disturbance due to this railway first showed itself in a blurring or broadening of the curve traced by the vertical force needle, but it was not sufficiently serious to destroy the value of the record. The disturbance remained about the same until the spring of 1897, when it gradually assumed larger proportions, and began to show itself also in the horizontal force and declination, the increase in disturbance being attendant upon a very heavy increase in the traffic of the road. Magnetic values are published to the millionth of a dyne, and it was found that a single car on the Glen Echo branch of the Tennallytown road increases the vertical force by 75×10^{-6} dynes. Occasionally, when the trolley wire broke and short circuited the line, there was a decrease of some $1,500\times10^{-6}$ dynes. The only other magnetic observatory in North America, that of Toronto, has had to be abandoned owing to similar disturbances. "It thus appears," says the superintendent at Washington, Commander C. H. Davis, in Terrestrial Magnetism, "that the use of powerful electric currents for commercial purposes has destroyed the usefulness of the only two magnetic observatories on the North American continent. . . . A remedy could possibly be reached by making it evident that the grounding of powerful electrical currents is either wasteful and extravagant or is working an injury to other commercial enterprises."

MISCELLANEOUS NOTES.

Acetylene gas furnishes lampblack of a very superior quality. Its use for this purpose has been patented in France.—L'Industrie Electro-Chimique.

Rotterdam (Holland) considerably improved its harbor facilities, and as a result the traffic showed an increase of 800,000 tons, or 20 per cent., in 1896 over 1895.—Uhland's Wochenschrift.

To prepare aluminum plates for lithographic use, Joseph Schulz, of Mayence, first grains the plate (for instance, by means of a sand blast apparatus) and then passes it between rollers.—Wiener Gewerbezeitung.

The Brussels Exhibition of 1897 has proved a great financial success. The shareholders had the amount of their shares refunded in full. The earnings of the railways showed an increase of $1,700,000.—Uhland's Wochenschrift.

One of the scenes in the new autumn melodrama at Drury Lane Theater, London, is Boulter's Lock, on the Thames, of a Sunday afternoon. The hydraulic lifts put into the theater by Sir Augustus Harris are utilized, funnels of steam launches, tops of punt poles, etc., are seen at first, then, as the lock fills, all the craft gradually rise.

According to M. Bergmann, graphite can be obtained by heating to 150° Centigrade, and under a pressure of 5 atmospheres, acetylene gas with oxygenated water. The same result is obtained by bringing calcium carbide in contact with water and treating the mass with diluted hydrochloric acid.—L'Industrie Electro-Chimique.

The folding bicycles supplied for the French army are now chainless wheels weighing about 28 pounds. They are made with drop frames, so that the soldiers can stand in firing position between the wheels. Tandems and triplets are also in use in the French army, their advantage being that the loss of a rider does not involve the loss of a machine.—Prometheus.

The first cotton spinning mill in India was started in 1851. In 1880 there were 56; in 1895 the number had increased to 148, and in 1897 to 173. In Japan, the first machines for spinning cotton were introduced in 1871. In 1880 five mills were erected with the aid of the government, and in 1896 the number of spinning mills in operation was 63.—Uhland's Wochenschrift.

Mineral Resources of Madagascar.—According to official French reports, gold has been washed in several localities. No silver has been found as yet. There are large deposits of copper and iron. Lead, zinc and mercury have been discovered, but no tin. The coal fields do not seem to be rich enough to allow of their being worked. Of precious stones, there have been reported amethyst, agate, topaz, garnet, sapphire, ruby, moonstone and others. Crystals of great value have been found in the province of Betsileo.—Cosmos.

A recent number of Zeitschrift für Elektrochemie discusses a process for the extraction of phosphorus and calcium carbide from basic slag. In this process tricalcium phosphate is mixed with an excess of powdered carbon and heated in an electric furnace, whereby calcium carbide, phosphorus and carbonic oxide are formed. The phosphorus passes over into a condenser and is recovered, the yield being claimed to be 80 per cent. of the total present in the mixture. The writer describes a series of experiments made by himself with a view of converting the phosphates of these slags into phosphides, the latter to serve as a deoxidizing material for overblown iron. The results, however, proved negative, the lime in the slag giving off its phosphorus and changing into calcium carbide.

Annual consumption of tobacco per head, in comparative numbers:

Netherlands	34·0
United States	20·0
Belgium	16·0
Germany	15·0
Australia	14·0
Austria	13·5
Norway	11·0
Denmark	11·0
Canada	10·5
France	10·0
Sweden	9·5
Russia	9·0
Portugal	8·5
England	7·0
Italy	6·5
Switzerland	6·0
Spain	5·5

—Cosmos.

Prof. Konig, of Göttingen, in an article on the disinfection of sleeping apartments in the Centralblatt für Chirurgie, says that at one time, while he was practicing medicine in Hanau, he suddenly discovered that his bedroom was thickly inhabited by bugs. A friend assured him that he could easily get rid of the pests, and proceeded to fumigate the apartment with corrosive sublimate. The success of this measure was most gratifying, and when the room was opened the dead bodies of various kinds of insects were seen strewn about the floor. This incident led the writer to hope that the same means would be effectual in destroying the infectious elements of contagious diseases, and a trial in private houses after scarlet fever of measles, and in hospitals after erysipelas or pyæmia, gave most satisfactory results. Since adopting this method he has never seen a second case of a contagious disease which could be attributed to infection remaining in the room in which the patient had been confined. The mode of procedure is very simple. From 1½ ounces to 2 ounces of corrosive sublimate are put on a plate over a chafing dish, and then the windows and doors of the room are closed. At the expiration of three or four hours the windows are opened, and the apartment is thoroughly aired. The person entering the room should take the precaution to hold a sponge or a cloth over the mouth and nose in order not to inhale the vapor. The following day the windows are again closed, and some sulphur is burned in order to neutralize any of the mercurial fumes which may linger about the furniture and other articles. The room is to be again aired and cleaned, and will then be ready for occupancy.

SELECTED FORMULÆ.

Antiseptic Paste (Poison) for Organic Specimens.—

(a) Wheat flour	16 oz.
Beat to a batter with cold water	16 fl. oz.
Then pour into boiling water	32 "
(b) Pulverized gum arabic	2 oz.
Dissolve in boiling water	4 fl. oz.
(c) Pulverized alum	2 oz.
Dissolve in boiling water	4 fl. oz.
(d) Acetate of lead	2 oz.
Dissolve in boiling water	4 fl. oz.
(e) Corrosive sublimate	10 grains.

Mix (a) and (b) while hot and continue to simmer; the meanwhile stir in (c) and mix thoroughly, then add (d). Stir briskly, and empty in the dry corrosive sublimate. This paste is very poisonous. It is used for anatomical work and for pasting organic tissue, labels on skeletons, etc.

Glue Paste for Cloth Books, etc.—

(a) White glue	4 oz.
Cold water	8 fl. oz.

Soak glue four hours in the cold water; then dissolve in a glue pot.

(b) Corn starch	4 oz.
Cold water	8 fl. oz.
Mix and pour into boiling water	16 "

Mix (a) with (b) and gently heat for about ten minutes. If wanted elastic, add 4 fluid ounces glycerine.

Thymol Dextrine for Labels on Glass.—

Yellow dextrine	8 oz.
Thymol	10 grains.
Dissolve in cold or lukewarm water	18 fl. oz.

Boiling water should not be used with dextrine, as it impairs its adhesiveness.—Western Painter.

Glycin Developer.—Glycin or oxy-phenyl-glycin, $C_6H_4OH{\cdot}NH{\cdot}CH_2{\cdot}COOH$, is very slightly soluble in water, but more so in alkalies and alkaline sulphites, and it is better made up in the form of one solution developer:

Glycin	16 g.
Sodium sulphite	40 "
Sodium carbonate	60 "
Distilled water to	500 c. c.

For use dilute with three times the quantity of water. Useful for negative and positive work.

Ortol Developer.—The latest developer is chemically a mixture of ortho-methyl-amido-phenol plus some hydroquinone. It is an extremely valuable developer, and is finding considerable favor.

No. 1.

Ortol	15 g.
Potassium metabisulphite	7·5 "
Distilled water to	1,000 c. c.

No. 2.

Sodium carbonate	120 g.
" sulphite	130 "
Distilled water to	1,000 c. c.

For use mix in equal parts. Useful alike for negative and positive work.

The Fixing Bath.—As a rule, the amateur will be content to make up his own, but it might be useful to know that the best fixing bath for negatives, especially with pyro as a developer, is an acid one, which may be made as follows:

Solution of tartaric acid, 50 per cent.	30 c. c.
Solution of sodium sulphite, 25 per cent	70 "

Mix and add to

Solution of hypo., 25 per cent	1,000 "

Intensifiers.—The most satisfactory is that generally known as Monckhoven's.

No. 1.

Mercuric chloride	20 g.
Potassium bromide	20 "
Distilled water	1,000 c. c.

The negative must be thoroughly free from hypo. and soaked in the above till quite white, then well washed and immersed in the following till blackened right through, and then well washed and dried:

Silver nitrate	20 g.
Distilled water	750 c. c.

Dissolve and add gradually quant. suff.

Potassium cyanide	20 g.
Distilled water	250 c. c.

This must be added and the mixture thoroughly shaken after each addition. At first a precipitate of silver cyanide is thrown down, which gradually redissolves in excess of potassium cyanide, but some of the flocculent cyanide should always be left floating in the bottle.

The Copper Intensifier.—This has lately been placed on the market, both as an intensifier and a reducer. It is prepared as follows:

(a) Copper sulphate	240 g.
Distilled water	500 c. c.
(b) Potassium bromide	180 g.
Distilled water	500 c. c.

Mix. In this the well-washed negative should be bleached, then well washed. To intensify, the negative may be redeveloped with any old developer, or, for reduction, only partially bleached and then refixed.

The Uranium Intensifier.—The action of this is so energetic that it is only applicable to very thin negatives:

Uranium nitrate	5 g.
Potassium ferricyanide	5 "
Glacial acetic acid	10 "
Distilled water to	500 c. c.

The negative must be thoroughly freed from hypo. and then immersed in the above solution till sufficiently dense. The color of the image is a reddish brown, which is far more non-actinic than it looks. Great care must be exercised in mixing this, and it should be kept in the dark. The ferricyanide must be well rinsed in water prior to solution, or else the solution quickly spoils.—Phar. Jour.

[Continued from SUPPLEMENT, No 1168, page 18699.]

MALAY LIFE IN THE PHILIPPINES.*

By W. G. PALGRAVE.

QUITTING the equivocal attractions of the cockpit, we engage a caramata, one of the light covered jaunting cars before described; the slim, scantily attired jarvey, sun-sheltered by his mushroomlike straw hat, and with somewhat of the professional humor of the Wellers of the earth on his boyish face, flogs into a canter the rough, grass-fed ponies of the vehicle, and away we go, passing under a highly decorated bamboo gateway, built up right across the village entry, and side doors for footfarers, the whole extemporized for the day's festival with a prodigality of material and labor seemingly out of all proportion with the means of the constructors. And now we are on the highroad, where the ditches on either side, and the spreading trees planted at short intervals for welcome shade, are almost the only indications that it is a road at all in the European sense of the term. Uneven, irregular, now rock, now mere soil rising in unmanageable hummocks, or deep scored into ruts and holes, a day's rain, as rain is in the tropics, would render it next to impassable. But we will suppose our excursion to be made in the dry or the half dry season, that is, at any date between October and July, best if in February or March, before the summer heats, too intense for average European endurance, have set in. Be our way then through the lowlands, rice districts, sugar districts; or be it, if more varied scenery attract us, amid the plantations of coffee, cacao, or abaca, of the hilly grounds. The rice fields are well watered with careful distribution. Mr. Fergusson does not err in assigning the palm of irrigative skill to the Turanian races; the cane patches, though small in individual extent, wave dense and yellow; the coffee bushes, unlike the cruelly mutilated stumps that do duty for them in Ceylon, spread far their straggling boughs berry-laden; the broad leaves of the shapely abaca plantain glisten emerald in the sun. But to all one feature is common, or rather all are distinguished by the peculiar absence of one feature, rarely missed elsewhere in the colonial tropics, namely, large estates. Rice lands, cane lands, coffee lands, hemp lands alike, all are divided and subdivided; and, however vast the green carpet of cultivation may be in its total extent, the irregular patches that make it up are not less infinite in number than capricious in shape. Equally remarkable is the absence of large agricultural establishments, buildings, factories, storehouses and the like. Is that diminutive shed, with a few low heaps of crushed cane refuse about it, a sugar mill? can that narrow thatch covering be a coffee depot? that rudely constructed handwork contrivance just seen through the plantain stems a hemp preparing machine? Yet such in truth it is, such they are; and, though specimens of somewhat more dignified dimensions may occasionally be found, they are rare exceptions, and may be counted, the archipelago through, on the fingers; while the grandest of them would sink into mere insignificance if transferred to Demerara or Martinique, Australia or Ceylon.

Large proprietors, in the accepted signification of the phrase, are rare in the Philippines, where "every rood of ground maintains its man;" and little room accordingly is left for the expansion of single estates. Little room, and, luckily, as we shall see, for the prosperity no less than for the happiness of the "natives," little agglomerated capital. Spanish capitalists here are none; and other European proprietors of land and field, from a variety of causes useless here to discuss, none worth mentioning also. Mestizos, that is, half-breeds, generally of Chino-Malay origin, are the most bulky estate owners; and the lands and fortunes they not rarely amass into one seldom hold together beyond a lifetime, but soon obey the eastern law of subdivision between heirs and fall asunder. The while far the greater part of the soil is in the hands of the Malays themselves, who, easily contented, and not much given to anxieties about fortune making and the future, till each his little plot, and make their bargains for disposing of the produce with the Chinese or semi-Chinese middlemen; by whom, again, it is transferred wholesale to European, chiefly British, merchants, and so reaches the coast and the cargo ships.

Votaries, if such yet there be, of the "Manila cheroots," so sadly deteriorated of late years, may wonder here that no tobacco growing district has been brought under our retrospective view. But these districts are almost wholly restricted to the northernmost region of the archipelago, and are, besides, so exceptional in every respect that they ought to be treated of, if at all, apart from any others. Their landscape is, I regret to say, a gloomy one, and I willingly refrain from the contrast of its somber tints with the bright and cheerful hues around us to-day; they are proper to nine-tenths, at least, of Philippine territory, and peculiar to it.

In most if not all other intertropical colonies—the West Indies, for example—the administration and enterprise alike are both of them essentially European, the labor alone native. In these "eastern isles," on the contrary, the Spaniards, content with administration, have left enterprise no less than labor to the natives themselves. The result is a very remarkable one; we have already, to a certain extent, seen it exemplified in detail and shall see more; let us now pause a moment to gather it up in one comprehensive view.

Eight million natives, more or less, inhabit the Philippines; and of this vast aggregate the principal, almost the only sustenance, morning, noon and eve, is rice. And what famine is, how frequent, how disastrous, how overwhelming, among a rice-subsisting population, the annals of Madras, Orissa, Ceylon, Bengal, have too often taught us. A calamity that, it would seem, no foresight can avert, to which no remedy can suffice. And yet, in the Philippine Archipelago, scarcity even is of rare occurrence, famine unknown; in the worst of years hardly a sack of grain has to be imported; in average seasons the land has enough for her children, all swarming as they are, and to spare. More still, after deducting the entire vast extent of soil and amount of labor devoted exclusively to this one staff of local life, enough remains of both to supply the export trade with an equivalent of four to six millions sterling in sugar, coffee, hemp, tobacco and all the other varied products of tropical agriculture. "Enough and over; enough for ourselves, and over and above for our neighbors," is the fact-spoken motto of the colony; and of how many other European colonies can this be said? Of any?

Whence, then, this abiding sufficiency? What is the want-repelling charm? Is it a better climate? A richer soil? A more regular and abundant rainfall than other island groups can boast? To some extent, perhaps; but such advantages, though they may contribute toward well-being, cannot of themselves effect it. Or is it greater skill, greater energy, greater aptitude for labor in the natives themselves? The Malay, like other children of the tropics, limits his labor by the measure of his requirements, and that measure is narrow indeed. No so much what they have, but rather what they have not, makes the good fortune of the Philippines—the absence of European enterprise, the absence of European capital. A few European capitalist settlers, a few giant estates, a few central factories, a few colossal money-making combinations of organized labor and gainful produce, and all the equable balance of property and production, of ownership and labor, that now leaves to the poorest cottager enough, and yet to the total colony abundance to spare, would be disorganized, displaced, upset, to be succeeded by day labor, pauperism, government relief, subscriptions, starvation. Europe, gainful, insatiate Europe, would reap the harvest; but to the now happy, contented, satiate Philippine Archipelago, what would remain but the stubble, but leanness, want, unrest, misery? The garden was the garden of Eden; its indwellers must needs harken to the serpent counsel, develop its resources, and be themselves cast forth from sufficient, unappreciated happiness, never to regain it, never return.

O balmy life-giving breezes of the wide Pacific, with enjoyment in every flutter of your wings! O golden glories of the evening sun god, ere yet he withdraws from view within his cloud-built palace of amber and crimson, reared on the deep immensity of blue! long be yours to range and reign over the waving emerald of the parceled rice field, the unpruned freedom of the fruit-clustered bough, the bannered flaglets of the yellowing cane patch, the green glister of the plantain grove, the triumph of the stately garden palm, while frequent amid them, each sheltering its contented owner-peasant and the children inheritors of the land, rise the little thatched cottages, undwarfed by the vast constructions of overshadowing capital, unsmirched by western smoke and enginery; while the fruit-bearing land smiles her bounty on her unorphaned children, and the children yet claim for their own the native bosom of their own land! Birthright ill sold for any counter exchange of elusive gain; Eden unequally bartered for the whole world of unrest and striving that seethes and struggles without the island bounds. Long may those bounds remain, long may they keep at bay the gods of the stranger, the price of the alien, the progress that is retrocession, the science that strips to nakedness, the energy that consumes and destroys, the greed of all-organizing, all-devouring capital, the skilled force insatiate of its slaves, the iron and the gold! And thou, cherished vision of southern fancy, virgin goddess of crowded shrines, Guadaloupe or Rosario, Lady of Refuge, Mother and Queen of Men, revive in this encroaching, all-absorbing age thy ancient legends of dangers repelled, invaders baffled, protected island shrines; and shroud in thy own mystic veil from the profane gaze of enterprise, from the intruding crews of progress, that fatal gift of beauty, fatal to so many of her sisters, the beauty of the Eastern sea nymph who clings to thy knees, nestles at thy feet, secure in thy shelter, happy beyond desire in herself and thee!

A few minutes of brightest twilight and the warm, star-spangled night calls forth the entire village, together with the flocking crowds who have come from the adjoining hamlets, in whatever they can muster of gayest ornament, silver or silk, to take their share in the fiesta of the district. From the pillared church front and the massive octangular bell tower close by, now illuminated by countless lamps from base to summit, the graceful bamboo-constructed arches, flung at short intervals across the main roadway of the village, and round by a complete circuit to the church porch again, form a glowing avenue of colored lanterns and transparent patterns and devices, beneath which the patronal procession is to pass. And here it comes, in two endless streams, men and boys in their fluttering blouses on one side of the road, women and girls in close girded silks on the other, all bareheaded and with lighted tapers in their hands, talking, laughing and merry, but great or small alike orderly and decorous in word and gesture. The foremost are a good way already ahead; and now behold a painted tinsel-crowned image, the Baptist it may be, attired in half military uniform, or St. Francis in his religious garb, or a virgin martyr, diademed and bedizened, with real jewels of price, diamonds, rubies, emeralds, glittering amid the colored ribbons and rags, borne along the midway between the files, high on a bedecked bamboo litter, amid a blaze of tapers that lights up as it passes the deep foliage on either side and overhead into a semblance of day. Then more processionists; and after a moderate interval a second demigod, St. Michael it may be, or St. Peter, perhaps, or any other worshiped ideal of the Catholic Pantheon, comes swaying along, more gorgeous than its predecessor; and yet a third and a fourth; and all the while, with occasional halts for gathering up stragglers, or clearing the way ahead, the procession moves on, a double serpent of brilliancy, and thickens as it moves; while from amid the illuminated houses and dense gardens off the road rockets shoot up their irregular greetings far into the starry silence overhead. But now the crowd is at its closest, and the black official jackets of the village dignitaries on one side and the brightest silks of their long-tressed helpmates on the other, usher in a gigantic litter, slow borne on the shoulders of the stoutest, stateliest devotees; where, throned amid a blazing pyramid of tapers, herself a blaze of tinsel and diamonds—

> "Our Lady comes smiling and smart,
> With a pink gauze gown over spangles and seven swords stuck in her heart;"

or some other avatar likeness of heaven's Queen; while all around swells the devout murmur of venerated triumph; close follows the village band, reinforced from the nearer hamlets, as it blares out its liveliest march; and "O Dea certe," in its Malay equivalent, fills every heart, and bursts from every tongue. "Idolatry! rank idolatry!" say you. And if so, what then? And what, I would fain know, is any worship, any rite man can offer to the Unknown Majesty, the Unknown Love, but idolatry, whatever the symbol, whatever the expression? Image, picture, statue, book, wood, stone, word, written scroll, printed paper, idea, thought itself, what are they all in the great god-poised balance but symbols, but idols? Be content, then, my friend, with your own favorite idol, the image of your choice; bow before it, set it up never so high on the throne of your own making, it is well; but sneer not at, seek not to pull down the idols of your brethren; perhaps they are no farther from the infinite truth they purport to symbolize than your own, like them finite too. Respect, though you participate not; give honor, though you refuse worship.

The procession winds on; and all the while a desultory firing off of rockets and bursting of crackers detain not a few of the faithful at its starting point, the village center, the green before the church, till, after an hour and more of slow circuit, the crowd, tapers, images, band and all, have re-entered the temple; and a solemn benediction, bestowed with all the efficacy that bells, books, candles, music, vestments and unquestioning belief can give, dismisses the worshipers to festivity and amusement; which, for the wealthier householders, means several hours of supper and dancing, song and cigars, in their own dwellings or those of their friends. Copious the supper, lavish the hospitality. What the night's entertainment will cost our worthy capitan, whose brilliantly illuminated sala is crowded with at least sixty hungry Malay guests, and thrice the number of uninvited spectators, come to admire the chandeliers, the decorations, the musicians and the dancers, often to join company with the last, and to partake in the unlimited refreshments set forth on the sideboards, I shudder to think. Perhaps so does he; but, at any rate, no outward sign of disquiet mars his composure, as with an unvarying smile of gratified hospitality he goes through the endless courtesies of a reception night.

But the chief attraction of this period of the evening, and one to which even supper and dancing, roast pig and polka, must yield in Malay estimation, is to be found out of doors, on the village square, not far from the church and the capitan's own house. It is a spacious booth, the framework of bamboo, gayly draped and festooned with cloth white and red, and surmounted by flags; within is a raised stage, side scenes and curtains, the whole brillantly lighted up, and open in front to the admiring crowd that will stand here and gaze for hours; on either side, reaching to some distance, rows of improvised boxes and seats, tier above tier, theater fashion, and hung with bright colors, give the more "fashionable" spectators view on the central stage. But boxes, seats, standing room, all are gratis to-night, when the village itself defrays the expenses of the common amusement. The drama is a Malay one, and the characters numerous—kings, queens, chieftains, damsels, grave counselors, nobles, soldiers and so forth, all in the gayest dresses of Malayan type. The plot is generally an adaptation of some Biblical story, that of David and Jonathan being the most often selected; sometimes it is taken from the hagiology; occasionally from semi-historical records of wars and reigns. The dialogue is commonly in verse; the acting more energetic than Hamlet might have approved; the music, abundantly bestowed as accompaniment, tolerable. But, whatever the theme, two characters, peculiar in their mode of adaptation to the Malay drama, are never wanting. One is a quaintly attired buffoon, who, the whole play throughout, and in the midst of the most serious or pathetic scenes, suddenly cuts in from time to time, now addressing the actors and actresses—the latter are most often, as on the old English stage, lads in female dress—with some absurd counterfeit of their own speeches and gestures, now mimicking them in a sort of stage aside for the benefit of the audience; and thus, in a rude fashion, supplying that side current of the comedy of human life, keeping pace with its tragedy, which the skill of Shakespeare never fails to present personified in the Stephanos and Pompeys, the nurses and clowns, of his noblest dramas. I should add that the Malay buffoon is very rarely coarse, never indecent, in his license. The other character is the prompter, not studiously unseen and unheard by the audience, as with us, but patent to all on the midstage, and reciting in a loud voice every sentence of the play, to be repeated after him with appropriate action by the characters themselves. The length of the performance, never under three hours, sometimes extends over as many successive nights, nor seems to tire the spectators. Meanwhile, roadside sheds, offering to Malay palates a tempting display of sweetmeats and refreshments, booths for billiard players, and other minor amusement or attractions, abound on all sides; drunkenness and disorder are conspicuous by their absence only.

Thus pass the hours till the approach of midnight is announced by a sudden glare of light and a noise like that of a well-sustained musketry discharge, summoning all who have not already by anticipation mustered on the spot, to the field outside the village, where the castel crowns in fire the rejoicings and glories of the festival.

It is, if not in general conception, yet certainly in detail, a genuine Philippine toy. A tower of two, three, or even four stages, is constructed of bamboos close interlaced and tied together, with turrets and battlements ad libitum, till the whole reaches twenty-five or thirty feet in height; above, below, and to every part of the framework, squibs, crackers, Catherine wheels, Roman candles and rockets innumerable, are made fast, ready for firing; and all about the castel itself, but at some little distance, rise outworks, also twined of bamboo, and densely covered with fireworks of every description. For weeks beforehand preparations have been going on, and the yet unkindled edifice, festooned with white or colored cloth, and bravely bedecked with streamer and flag, has been the favorite resort of afternoon crowds, a constant center of joyful anticipation. Now its hour is come; midnight draws on and the waning moon yet hangs low in the dark sky; when suddenly a preliminary upburst of some scores of rockets, grouped clusterwise, and filling the night air as they explode with floating showers of soft falling stars—green, red, white, purple, blue—ushers

* In Cornhill Magazine.

in the grand act of the castel. From every side, every angle of barricade and tower, the fire rushes simultaneously forth, crackling, hissing, exploding, a fairy pandemonium, lighting up the tall trees and bamboo clusters in the fields around far and wide, and every face in the thick-gathered crowd beneath; for not a man, woman or child, of all who have attended the fiesta, would for any human consideration miss the spectacle, the very bourne and utmost goal of their inventive delight; and at each fresh explosion the rapturous applause rises higher till it reaches the highest pitch of excitement consistent with the habitual impassive calm of the Malay character. Sometimes this excitement is intensified by the added sport of a fiery bull —that is, a wicker framework more or less representing the animal, and well protected by thick hides, outside of which squibs and crackers are fastened in plenty, while a couple of men concealed within the hollow, and protected from the blaze without by the hide covering, make the burning, crackling monster rush hither and thither among the spectators, who skurry away on all sides in real or simulated alarm, amid shrieks and laughter. Thus midnight passes, and the merry tumult is at its loudest and maddest when, all too soon, the castel fires wane and dwindle, the explosions cease, the last rockets shed their sinking stars, and a few minutes later all is darkness and silence over the trampled field; noiselessly, rapidly, the crowd has melted away and dispersed each to his resting place to sleep out the brief space left till dawn, and the moon, left sole queen of the night, casts her white veil in a semblance of thin snow over grove and garden, church and home roof, where a few expiring lamps yet twinkle amid a stillness like the stillness of the dead. We return to the room prepared for us by our host of the day before, and the bright morning sun wakes us to find the husbandmen already gone to early mass, or out with their buffaloes in the fields, the women moving to and fro with their water jars, or washing clothes in the neighboring stream; streets and roads are all alive with slight clad wayfarers and creaking carts, and the daily current of village life is flowing calmly in its wonted channels, as, escorted to the outer gate by the capitan and his attendants, we take our leave, and fare forth on our journey by sun and shade, mountain and river, hamlet and field, back to Manila.

To Manila? I lean over the low bulwarks of the "Leite" as the little craft cleaves the southwestern way toward the straits of Singapore, and now see nothing around but the green heavings of the tepid China Sea; the last dim outline of high Mindoro and wild Palawan, westernmost island of the Spain-ruled archipelago, has faded into sky; and the swarthy, active, boyish-seeming crew of sailors and firemen is all that remains in presence yet for five voyage days more of the Philippines and their inhabitants. Passed Singapore; and these, too, will be things of the past. But of all tropical lands, all tropical races that it has been my lot to visit, none will have left a pleasanter, a more heart-satisfying memory than the Philippine Archipelago, the home of the half civilized Malay. Is wholly civilized Europe, is England herself, a better home to her children? A happier? Compare and judge.

SCHNEIDER-CANET QUICK-FIRING BREECH MECHANISM.

THE Schneider-Canet system of quick-firing ordnance contains many types of breech closing apparatus. All are characterized by the successive performance of the opening of the breech, the extraction of case and the closing of the breech by a single stroke of the lever; consequently the working is easy and assures the greatest rapidity in loading and laying. The description below of the 15 cm. (5·9 inch) breech gear furnishes an example. The complete mechanism comprehends only a small number of simple, strong pieces, which can be put together or taken asunder easily by hand without the use of any tool. The striker is automatically set or cocked. In case of a misfire, it is only necessary to draw back the striker again by hand by means of the ring (see A, Fig. 1 and Fig. 4). All the pieces of this action are hidden and protected by the cover in the same figures. In order to fire by electricity it is only necessary to substitute for the striker, A, the contact piece, etc., C (see Figs. 9, 10 and 11).

The movement of the lever is generally from left to right to open, and inversely to close the breech, but the hinge may be as well placed on the left and the action reversed. Figs. 1, 2 and 3, which show the 75 mm. (2·95 inches), illustrate the latter and the subsequent figures the former arrangement.

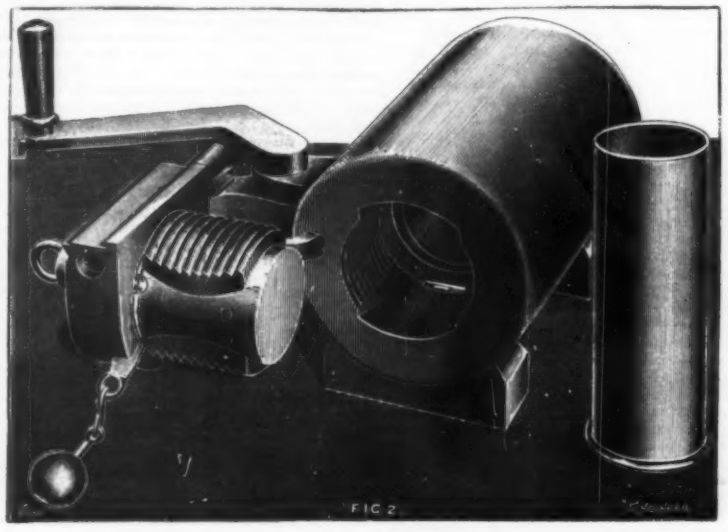
The mechanism contains the following parts:

(1) Breech screw (see D, Figs. 2, 3, 5, 8 and 10) is held and supported by the cover by the screw thread shown in Figs. 8 and 10, which is of the same pitch as that of the breech of the gun. The threads of the breech and of the breech screw are interrupted, as shown in Figs. 2, 3 and 5, the interruptions being at the highest and lowest quarters of the circumference in the former. A rotation through 90 degrees suffices to disengage the threads from each other, and the form of the parts is such as to render it unnecessary to draw the breech screw back in order to clear the breech; a single motion swings it out held in the cover, as shown in Figs. 2 and 5.

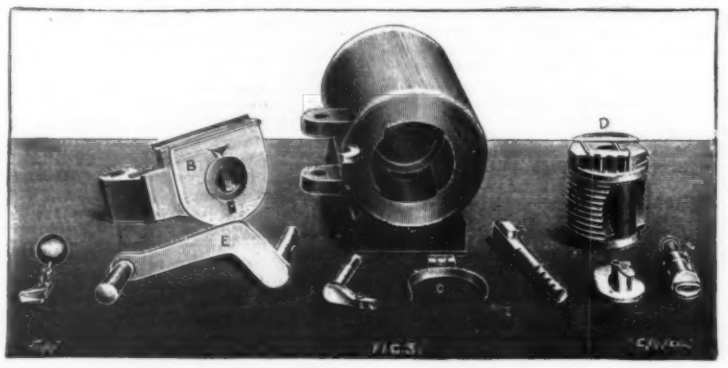
(2) The hinged cover is of bronze and is threaded with a screw which holds and guides the breech screw. It contains also the seat of the rack and of the rack bolt (see Fig. 7) and of the trigger.

(3) The lever is in one piece with the axis bolt of the hinge (see E, Figs. 3 and 5). It carries the pin which moves the rack, which imparts rotation to the breech screw by means of the recess (F, Fig. 7) and the chain (see Fig. 2) which holds on the cover. It is worked by its vertical handle, which is automatically clamped in the cover as the breech closes, so as to prevent any accidental unscrewing of the breech screw.

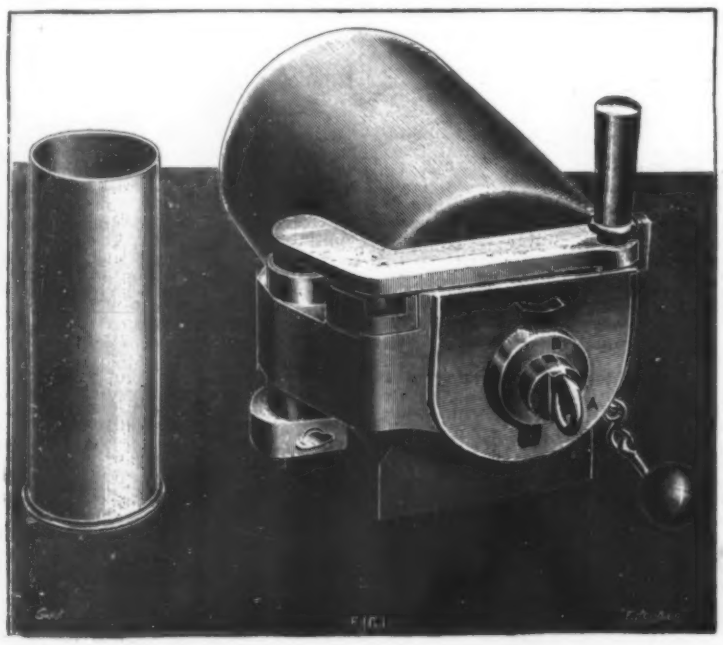
(4) The rack, sliding in the cover (see C, Fig. 7), gears with the pinion teeth of the breech screw (see Fig. 7) and carries at its extremity a recess, F, into which the pin of the lever works.



75 MM. GUN, BREECH OPEN.



DETAILS OF MECHANISM.



75 MM. GUN, BREECH CLOSED.

(5) Extractor (C, Figs. 3 and 5), fork-shaped, is furnished with two branches which hold to the front of the rim of the case and dislodge and eject it. It is actuated by means of a stud and arm connected with the axis bolt of the hinge.

(6) Arrangement for Firing by Percussion. — The striker (see H, Fig. 4) held in the center of the breech block has two symmetrical helicoidal grooves which bear at the moment of opening on two similar grooves in the screw. The cocking spring is placed between the head of the striker and a spindle with flanges (see Fig. 8) which holds in the breech screw and cannot participate in the movement of the striker. A key through the cover and striker prevents the latter from turning round and permits the longitudinal movement set up by the reciprocal action of helicoidal grooves. The compression of the cocking spring thus results from the back movement of the striker.

(7) Firing by Electricity.—For this the striker is replaced by the insulated circuit and piece (shown at I in Fig. 10). The breech being closed, contact is made

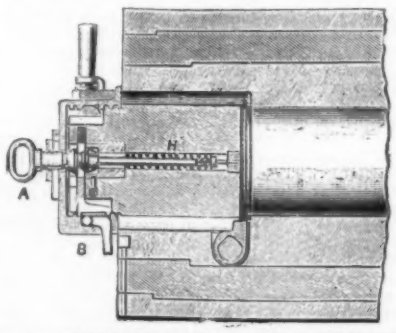


FIG. 4.—SECTION OF BREECH MECHANISM.

with the center of the electric tube in the base of the cartridge. An insulated flexible conductor completes the connection with a contact spring on the cover, and when this latter rests against the end surface of the gun, the spring bears on the stem of a conjunctor fixed on the gun. This conjunctor has a spring check and a spring contact maker with an ivory finger piece, which last, placed with regard to the rack, is pressed at the instant when the closing of the breech is completed, and determines the electric contact of the spring and the check. Firing is effected by means of a circuit closer, worked at will by the pointer or laying number at the gun.

Working.—The breech is opened by a single motion. In working the lever handle, the clamping catch disengages itself from the cover, thus allowing the move-

ment of the working lever. The pin of this lever draws back the rack which turns the screw, whose rotation draws back the strike and compresses its spring. At the end of this movement the sear engages on the piece at the rear end of the striker and thus holds it cocked. As the unscrewing finishes, the side of the

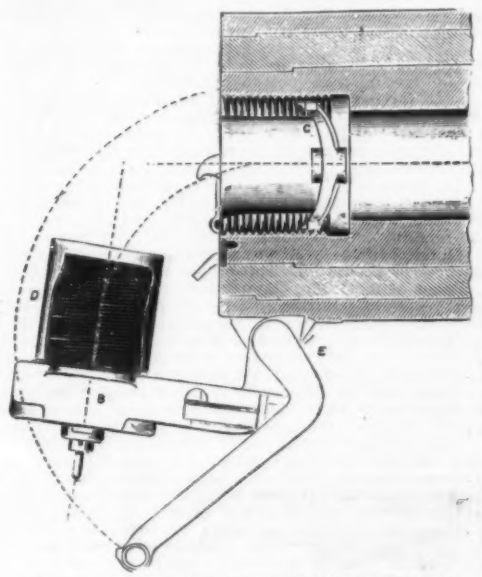


FIG. 5.—SECTIONAL PLAN OF BREECH MECHANISM.

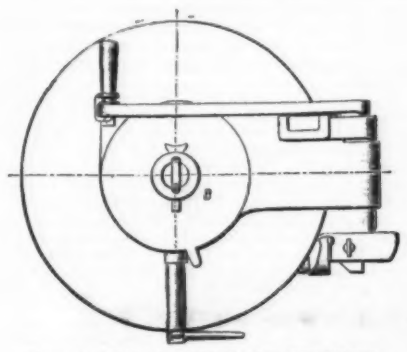


FIG. 6.—REAR VIEW OF BREECH.

FIG. 7.

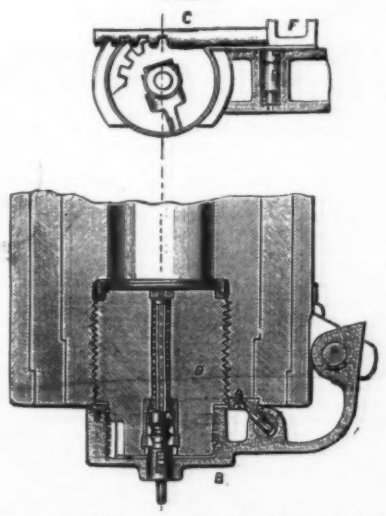


FIG. 8.—SECTIONAL PLAN OF BREECH MECHANISM CLOSED.

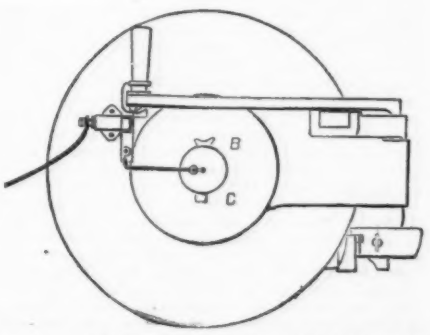


FIG. 9.—ELECTRIC FIRING ARRANGEMENT.

axis of the hinge strikes the cover and draws it in its continued movement of rotation until it is stopped by contact against the gun. The breech is then fully open.

When the unscrewing of the breech screw is completed and the cover begins to swing round on its axis, the catch bolt actuated by its spring engages in the rack and holds the screw at rest in the cover, and when the breech is nearly clear of the gun the groove of the pin presses on the button of the extractor axis, and this last turning dislodges and then ejects the empty

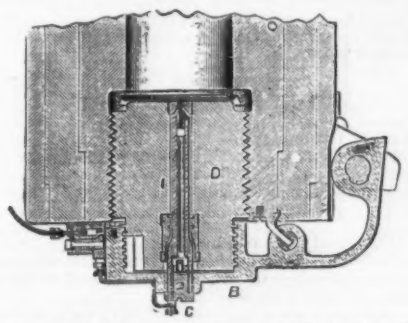


FIG. 10.—ELECTRIC FIRING ARRANGEMENT—SECTION.

case to the rear, which the gunner catches with his hands.

As before said, one movement closes the breech. After entering the charge in the gun the lever is completely moved from right to left. This performs the entire work in its stroke, for the pin is engaged throughout in the rack, and this latter is fixed in the cover by its bolt, but when the cover meets the end of the gun, a projection fixed in the piece brings down the bolt of the rack, this last becomes free, and actuated by the pin of the lever, turns the breech screw.

Safety Arrangements.—The percussion and electric gear alike prevent firing from being effected before the breech is completely closed. The sear being placed in the screw and the trigger in the shutter, the action of

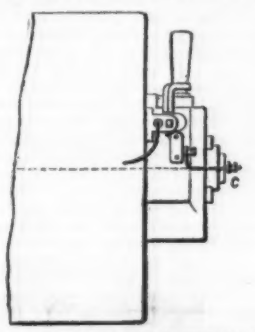


FIG. 11.—ELECTRIC FIRING ARRANGEMENT.

one on the other can only take place when the nose of the sear comes on to that of the trigger; and in this way it is impossible to fire the gun if the breech is not completely closed.

So with the electric firing. One of the connecting pieces is fixed on the cover, the other is in contact with the body of the gun and carriage, so that so long as the breech is not completely closed, no contact is made (see Figs. 9, 10 and 11).

As already said, the clamping of the lever handle prevents the unscrewing of the breech. Lastly, a special safety arrangement prevents the breech from opening if firing has not taken place, either from a misfire or hangfire. The action is as follows: When the breech is closed, a small block pushed by a spring and placed in the end surface of the gun engages like a bolt in a recess in the rack and prevents it from moving. It carries laterally a spring catch. On firing, the gun recoils, and the small block by its inertia enters into the gun and frees the rack, the spring catch hinders the return of the block, and it is then possible to work the lever and open the breech. On the other hand, if the gun does not go off owing to a misfire or a hangfire, the gun does not recoil, the block remains engaged in the rack, rendering it impossible to move the latter, so that to open the breech it is necessary to move the small block by hand. This breech gear then, like all other of the Schneider-Canet system, provides all the security desirable for regular rapid working and frees the men engaged from distraction. Finally, this type of breech, which applies equally to naval and land service, is characterized by simplicity, rapidity of working and taking asunder, by absolute security in its action and strength in all its parts. We are indebted to The London Engineer for the cuts and particulars.

THE REVOLVING STAGE OF THE VARIETY THEATER AT PARIS.

THE application of turntables to the setting of stage scenery is not new, since our contributor, M. A. Tissandier, observed some curious examples of it in Japan, especially at the Yamada Theater, and tradition has it that this type of installation has been employed there for a great number of years. It permits of placing two or three scenes upon the same stage at once, in such a way as to make them come into play successively within a very short space of time and thus reduce the interval between acts to a minimum.

As shown in the diagram of the arrangement adopted at the Yamada Theater (Fig. 1), the revolving platform is placed in the middle of the stage. In the play witnessed by M. Tissandier, the back of the scenery showed the entrance to a house, and upon the movable side scenes, A A, there was represented a street and a contiguous garden. The actors pretended to enter the house, and this gave the signal for the change. As the scenery was almost entirely mounted upon the movable platform, A B, set in motion by manual power, it immediately revolved along with the actors who were standing upon it. When the rotary motion ceased, there appeared to the eyes of the spectators a house, B, which had been prepared behind the first scene. The movable side scenes which represented the street and garden, being turned around by the machinists, completed the ensemble of the new scene.

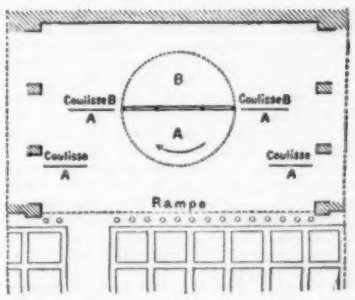


FIG. 1.—PLAN OF THE STAGE OF A JAPANESE THEATER WITH ITS REVOLVING STAGE.

It must be confessed that such a system of scene shifting is somewhat primitive and wholly suppresses illusion. Entirely otherwise is the result obtained in the piece called Le Nouveau Jeu now playing at the Variety Theater of Paris. The fifth and sixth tableaux are devoted to two scenes of the same kind—an exhibition of acts performed now to the profit and now to the detriment of the same persons. In order that the comical effort should be complete, it was necessary that the impression of the spectators should not be allowed to cool. Thanks to the use of the revolving platform, which carries the scenery of the sixth tableau all set at its back part, it suffices to darken the stage for a few instants in order to effect the necessary change. Fig. 2 represents the stage of the Variety Theater at this moment. The opening of the stage between the two strip lights is 28 feet and the revolving platform is 41 feet in diameter. The latter rests upon two series of 24 inch iron rollers with horizontal axis. The diameters of the two tracks are respectively 8¼ and 34⅓ feet. The setting in motion is effected by means of a cable

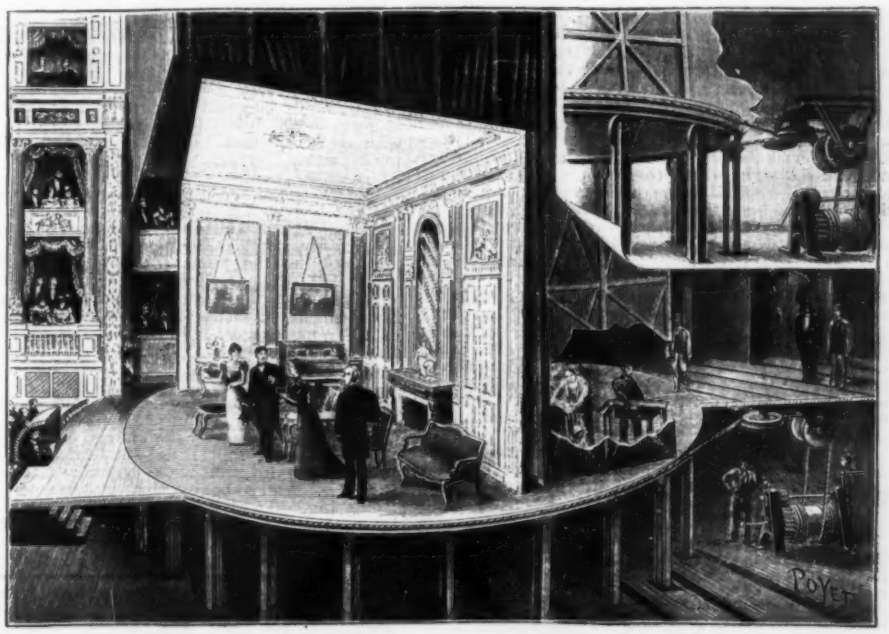


FIG. 2.—REVOLVING STAGE OF THE VARIETY THEATER AT PARIS.

that surrounds the platform and passes over tension pulleys with a vertical axis, the position of which is controlled by counterpoises, so as to guard against elongations due to humidity. The cable next passes over guide pulleys and winds around a windlass actuated by two men. Strips of wood, properly arranged, furnish stops against which the revolving platform abuts.

Advantage has naturally been taken of the facilities offered by the arrangement to reduce the duration of the entr'actes, and to set the scenes at will at certain periods of the play; but its best raison d'être and its most remarkable success consist in the repetition of the scenes of which we have spoken and that no other device would have permitted of realizing with the same perfection. The whole operates without any noise and with perfect regularity.

The arrangement adopted in the Yamada and Variety theaters lends itself only to the use of scenes without much depth, because the back canvas is established according to the diameter of the revolving platform parallel with the footlights.

M. Karl Lautenschlager, head machinist of the Munich Opera House, has obviated this inconvenience by placing the back canvas almost upon the circumference of the platform or else according to a diameter oblique with respect to the opening. The arrangement employed by him at the Court Theater, of Munich, is essentially as follows:

On the ordinary stage is placed the revolving platform, which raises the floor slightly. This platform is 52 feet in diameter, and presents not quite a quarter of a circle to the proscenium opening, which is 32 feet 9 inches wide. It turns on rollers that run on a circular track; the revolving mechanism is driven by electricity. If a scene is set on the quarter circle presented to the audience—perhaps a closed room of considerable depth—something similar can be arranged on the opposite side of the platform which opens to the rear of the stage, as well as on the other quarters, so that four different scenes are set on the stage at the same time. For a play of four acts, requiring a different setting for each act, all four scenes can be prepared beforehand, and at the end of the first act the stage is turned a quarter of a circle (which requires about ten or eleven seconds), and the scene desired for the next act is presented to the audience, and so on at the end of each act. In case three changes were required in one act, after the portion of the stage occupied by the first scene had been turned away from the audience, it would be cleared and set for the first scene of the next act. The scenes need not be limited to representations of closed rooms; any desired scene can be set on the turning stage, and, if necessary, the whole stage can be used the same as any ordinary stage. Difficulties will occur only when two scenes requiring great depth, for instance, two landscapes with distant views, follow one another. But Lautenschlager has shown that even these difficulties can be overcome by setting the scene along the radius of the circular stage so that the portion used decreases considerably toward the rear, and in this way he gains the entire depth of the stage for another scene. Much more of the artistic element enters into the setting of a stage of this kind than of a stage that is set on straight lines.

A full description, with illustrations, of the arrangement employed by M. Lautenschlager will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1078, page 17230. For the particulars and illustrations of the arrangement employed at the Yamada and Variety theaters, we are indebted to La Nature.

THE MAKING OF A STAINED GLASS WINDOW.

By LEWIS FOREMAN DAY.*

THE making of a stained glass window: how it can be made; and how it should, I think, be made—that is the subject on which I am going to speak to-night.

With the history of glass, with style, we have nothing for the moment to do, and even with design we are concerned only in so far as it bears relation to ways and means, and is determined by them.

A stained glass window is in the first place glazing; a mosaic, that is to say, of pieces of glass—quite strictly a mosaic; as much a mosaic as, for example, a Roman pavement, only it is not marble or any opaque substance that is used, but translucent glass, and the pieces of shaped glass are held together, not by cement, but by an open framework of lead, strips of lead, that is to say (in section something like a capital H) and connected together at the joints by soldering, are the means we have finally adopted for framing our translucent glass, just as the old enamelers used "cloisons" of metal to form cells for their vitreous colors. Indeed, it is to cloisonné enamel that stained glass in its simplest and most direct form is most nearly related, and not to painting at all.

A mosaic of stained glass can be made, and often has been made, in which the setting is not lead, but stone or plaster. This, however, is an Oriental practice, which has not been much used with us, though there is no reason why it should not, except that our aim is nowadays mostly more or less pictorial, and the Oriental method lends itself more kindly to ornamental pattern.

I have seen a window in which the framework of the glass was of bronze, if I remember rightly. I have myself used a fretwork of brass, zinc, or wood, but the accepted way of glazing is with lead, and on the whole lead is probably the most convenient thing to use. I show you on the screen a couple of Arab windows, the one probably of stone, the other certainly of plaster; and in the next slide a portion of the last mentioned is in color.

A window of this kind may be regarded as a kind of magnified version of the jewel setting of the East (imagine the setting to be open), in which stones more or less precious are used, less for their intrinsic value than for their liquid and luscious color.

The use of small pieces of glass was in the first instance obligatory. Glass was made only in small pieces, and it was precious, far too precious to let even the smallest bit of it be lost.

The scientific century in which we live has achieved monster panes of plate, and we are independent, therefore, of the glazier in so far as clear white glass is concerned.

But for colored windows, unless they were each all of one color, the ancient practice still holds good. We have a fuller palette than the mediæval workman (whatever that may be worth), but for each individual color in a window (with the exceptions presently to be made) we have to use a separate piece of glass; and it is the mosaic of these pieces which makes the stained glass window.

For the color of stained glass, observe, is in the glass itself. That is to say, in the melting pot, with the ingredients of the glass, there is mixed a mineral oxide, copper, cobalt, manganese, which, when the whole mass is molten, stains it red, blue, purple, and so on; for which reason this through-colored glass goes by the name of "pot metal." The term is one to remember: pot metal, i. e., glass colored in the melting pot.

MOSAIC.

A stained glass window, then, is in the first place a mosaic of pot metal glass, in which the outlines of the design correspond with the lines of lead with which the glass is bound together.

In a mere pattern design of very pale tints of glass (technically "whites") these lead lines are first to strike the eye; in fact, they are the pattern. But if the design is in fairly strong colors, or in white and color, then it is the surfaces of glass which call your attention, and the framing lines of lead are more or less lost in the color, as may be seen (as far as it can be shown in black and white) in the little strips of pattern on either side of the screen.

Experience proves that in the case of, for example, a white pattern on a deep colored ground, the leads outlining it are merged in the ground, and any lead joints crossing the ground—not part of the design, that is, but introduced for the sake of strength or for other constructive reasons—pass without notice. They do no harm, that is to say. On the contrary, they may be turned to very good account, and the artist takes advantage of them to get variety of color, which is always so much to the good.

To the good also is the emphatic outline which the lead naturally gives, for the light, as it shines through the glass, diffuses itself, spreads and softens everything, so that the harsh line is not harsh in effect.

A mere mosaic of colored glass does not go very far, you may say! I have a very strong feeling that it might be made to go much farther than it has ever been carried, that for clerestory and other distant windows it offers splendid opportunity for big, manly, decorative work, in which the material (glass) and its jewel-like brilliancy would be seen at their very best.

But this kind of mosaic (pure mosaic I am speaking of) has never been worked for "what it is worth," because what the patrons of glass, mediæval and modern, have always desired was not so much decoration as picture, and in particular they wanted the window to preach. And so ornament (which Western people don't in their hearts care about) gave way to saints, and scenes from their lives, and so on. In that direction mosaic, except upon a very big scale, cannot go far. For instance, you can cut a piece of glass to the shape of a face in profile, but for the eye, the ear, the drawing of the mouth, the glazier cannot give you that.

Here comes in the painter!

Just as the glazier, wherever he introduces a leaden outline, stops out the light defining the shape inclosed by it, so the painter may, with solid pigment, stop out finer lines and give detail which the glazier could not. That is to say, the painter can go round the necessarily rather blunt outline of the glazier and accentuate it. He can with his sable pencil make little incursions into the area of the glass where the thick lead would not have room to turn. A leaf, say, is represented by a piece of glass cut heart-shape; the glazier emphasizes that with his lead; but the painter can give you the serrations round its edge, and he can pencil in the veining. This linework is technically known as "penciling" or "tracing." So far, observe, the painter only does, in a freer and more delicate way, what the glazier does in his rough and ready fashion; that is to say, he only stops out the light. He employs paint not as color (that is in the glass) but as obscuration. Glass painter's paint, you must know, is an opaque brown vitreous compound fixed to the glass by fusion in the kiln—permanently if the color is hard enough and the fire sufficient.

On light colored glass—white, or what goes for it—the traced line is advantageously employed, not only for outlining the pattern, but as a means of getting a tint to throw it up. In windows like that you do not notice the cross hatching of thin lines; you get at a distance the effect of a tint.

That would be so on paper, but it is much more so in glass, owing to the spreading of the light; and the wash of color, which might be more transparent upon paper, would on the glass produce only a muddy effect.

The process of scraping lights out of the solid paint is an obvious device, which was employed from the beginning. If you want rather fine lines of light or dark, it is plainly much easier to pick them out with one stroke of the stick than to paint round both sides of them. Picking out came in very handily for pattern work; even crude tinted glass will pass muster when it has been coated with paint and a diaper scratched out of it. What was crude in the mass is only bright in the form of filigree.

PAINTING.

The glass painter's pigment, I said, shuts out the light. If, however, his brush is not fully charged, or if there is proportionately not enough coloring matter in the pigment, the light is not shut out entirely. A thin film of the paint, that is to say, only partially obscures the glass. And so begins what may properly be called "painting," in which the color of the glass is modified by paint. We are on the way now to shading and modeling.

Glass, however, is rather a slippery surface to paint on. It is non-absorbent; there is no hold for the paint; painting upon it is as different from painting on paper or canvas as walking on ice is different from walking on dry land. And the glass is as treacherous as ice. Attempt to retouch what you have done, and it gives way beneath you. If you look at any very early mediæval shading, you will find it takes the form of a smear (about as flat as they could get it), answering its rude purpose, but that is all that can be said for it. A step in advance is to paint the shadows as best you can, and then dab or stipple the paint until you have got something like texture to it. Obviously you can dab it unequally, removing more paint in some parts than others, and so get gradation of tint. And this stippled surface has an advantage in that it lets light through, and, where the paint is thinnest, you get specks of nearly pure light in the shadows, and so do not lose all translucency in them.

A further step in painting is, having traced your outlines and fixed them in the fire, to coat the entire surface of the glass with a film of paint, and dab it with a stippling brush till it presents an equal granular surface all over. When this "matt," as it is called, is dry (but before it is fired) you rub off with your finger tip the pigment from the parts that are to be light, and then, with a dry hog hair brush, dust away part of the remaining paint, until by degrees you get the intermediate tints you want between the clear glass and the solid matt. By this means you can get great delicacy of modeling, though you may have to repeat the process of painting (if so it should be called), and repeat it more than once, to get what you require, more especially as a fierce fire may wipe out all you have done. You get sharpness of detail by brush touches of stronger color, and by scraping out lights with the stick end of the brush or other pointed implement; carrying further the practice already explained apropos of diapers. Obviously you may just as well scrape lights out of tint as out of solid black.

In what is called painting, the point becomes eventually, perhaps, the most important implement of the glass painter. He gets by that his most minute detail, his subtlest modeling, and texture (as, for example, in hair, fur, feathers) to be got no other way. It turns out, then, that "glass painting" in its most accomplished form is not the putting on of paint, but the removing it. It is more nearly allied to mezzotint and etching than to painting. Just as the mezzotinter first rocks his copper and then scrapes down his lighter tints, so the glass painter lays his matt upon the glass and dusts it off to get translucency. Just as the etcher coats his plate with varnish, and with a needle cuts through it to the copper, so the glass painter lays a coat of pigment on the glass and etches through it to the light.

Of course, all or any of the processes described may be used in a single glass painting. For strong, bold work the elementary processes still suffice; for modeling the brushing-out process is most useful; for delicate finish the point has to be used. Delicate work, owing to the difficulty of painting over paint not fixed in the kiln, has often to pass several times through the ordeal of the fire (and it is an ordeal), but accomplished glass painters can do wonderful things in the way of floating color over unburned color, using, it may be, more than one medium; but to do that you must know just how your medium will behave throughout, and you must be extremely dexterous. I need not go into that, because the expert will know more about it than I do, and there is no use in the inexperienced trying their hands at the masterly. Glass is sometimes painted on both sides. I should say that the medium commonly used is either water, with gum or sugar enough to hold the color, or oil of turpentine—fat oil, as it is called.

GLASS.

With regard now to the glass itself. Folk still go on mumbling the old legend about "lost secrets" in the art of glass making. That is all nonsense. True, the making of glass such as that to which we owe the glory of old windows had fallen into abeyance. The right kind of glass was no longer being made, and when Winston (with the aid of Messrs. Powell & Sons) wanted to revive it the traditions had died out, and they had to solve the problem for themselves. But modern science was equal to the occasion. There is now no mystery whatever about the composition of old glass; and we can make to-day glass quite equal to any that was ever made, and do besides what the mediæval men could not do. The artistic merit of old glass was in its chemically imperfect composition. It was not only irregular in thickness and in color, but striated and flecked with air bubbles; the light coming through it was, consequently, broken up and deflected, as if by an infinite number of tiny prisms, and so we get the lustrous richness of tone which distinguishes the gorgeous color of fine glass from the crudity of mechanically and chemically perfect material. This fact once appreciated, there was no great difficulty (to the expert) in making the chemically and mechanically imperfect glass which goes to make perfect windows. What the old makers got by accident the modern get of set purpose—that is all.

There is, however, one advantage which the old material has over the new. We are accustomed to think of glass as practically imperishable. It all depends upon the glass. If there is an excess of alkali in it, glass is literally soluble; it takes a long time to dissolve, of course, but eventually it will dissolve in water. The old glass was anything but homogeneous in its composition; certain particles were more alkaline than the rest, and these more soluble particles have really been washed out of it by the mists and rains of ages, leaving it, on the weather side, all rough and fritted, like an oyster shell. Hence, more prisms, more refraction, mellower and more beautiful color. The moral is: let us not make our material so scientifically perfect as to resist the kindly ripening of age.

I told you glass painting had to be burned in. In firing the glass you may change its color. This is an accident which happens especially to ruby. In the specimens I showed you (part white and part ruby) there is probably in the glass more copper than has actually been converted into color in the pot. In the kiln this would most likely be brought out, and the white parts would come out ruby, and the ruby parts become so dense as practically to shut out the light. Some colors, therefore, you dare not paint upon for fear of the fire. This difficulty is got over by painting on a piece of white, and glazing this and the colored glass together (two thicknesses of glass instead of one). The effect is the same as if the paint were on the colored glass. Perhaps this process of "plating," as it is called, is sometimes necessary in the pictorial

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interest, but glass which will not stand the fire is best reserved for portions of the design (background, etc.) which do not need to be painted. "Plating" is used also to get certain tints not forthcoming in any single sheet of glass. That is easy to do, but it is not quite the game. The space between the two pieces of glass is not hermetically sealed; fine dust penetrates, and in time dulls the color; the surer, but more troublesome, way would be to fuse the two together in the fire.

The annealing of small pieces of colored glass onto white is also possible, and was practiced in the sixteenth century. The jewels in the crown of the saint on the screen are represented in that way. The crown is stained, the pearls white, the jewels (ruby, sapphire, amethyst, glass) onlaid and annealed. But, owing to the different consistency of the glass and consequent unequal contraction and expansion with every change of temperature, these onlaid jewels are not very safe, and you generally find one or two of them missing.

FLASHED GLASS AND STAIN.

When I said that in stained glass the color was in the glass, I said there were exceptions. The first of these is what is called flashed glass. In "ruby" glass, for example, the coloring matter (copper) is so powerful that a sheet of red glass thick enough for strength would be practically non-transparent. This difficulty is got over by making the glass consist of two layers—not a layer of color upon glass, but a layer of colored pot metal upon a layer of white glass. Ruby, then, is always flashed, a certain kind of grayish blue is flashed, and any color may be; you may have a layer of one color over a layer of another color (not white)—perhaps there are tints yet to be got that way which might be serviceable—but it is chiefly in the case of strongish color upon white or whitish glass that flashing is practically worth while, for flashed glass admits of a treatment peculiar to it. You can, by means of acid, etch away the colored layer of glass, exposing the white beneath. (Formerly the red layer had to be laboriously abraded, ground away, but acid simplifies the work and makes it easy.) By this means you can get, let us say, a white pattern on a red drapery. Quite elaborate designs were ground out in the fifteenth and sixteenth centuries, and there are practically no limits to what we can do by acid.

STAIN.

There should be mentioned a second exception to the rule of glass being colored throughout, and even of being colored in the pot. There is one color with which glass may be stained (not painted) after it is made. If you paint a piece of white glass with a composition containing a certain amount of oxide of silver, the silver will, under the action of the fire, stain the white glass yellow—deeper or lighter according to the strength of the solution and the heat of the fire. The yellow varies from palest lemon to deepest orange, but always pure and transparent, unless it has been overburned, in which case an opaque brownish deposit is formed upon the glass. (Glass painters say this is "sulphured;" really, I believe, the silver oxide becomes metallic silver.) This yellow stain penetrates the glass, and is as permanent as the surface of the material itself. You can get, by using it upon white glass, most beautiful effects of silvery and golden light. You can stain on yellow pot metal or upon stain; you can even paint with stain, graduating so as to get, for example, very much the effect of embossed gold; you can stain on blue, and get green; on purple, and get olive, and so on.

In the portion of a rosette on the screen (reflected from actual glass) you will see the four rows of petals are of four distinct shades of yellow (defined by the "traced" outline), the white glass showing itself in the eye of the flower. In the diaper (also from the glass) the yellow ground is gradated (those cross lines have no business to be there), and perhaps the most beautiful effects of stain are where it is floated on irregularly. The result is sometimes deliciously juicy.

A more pictorial use of stain is shown on the screen in the two kings, from the "Adoration of the Magi." That is a piece of actual glass—old Swiss—and you see in it a deeper specimen of stain than yet shown.

In the figure from the Last Supper on the screen, the lower drapery is very elaborately enriched with pattern in yellow; and the vase to the right (which is of warm gray blue) is patterned with greenish yellow. (That is at South Kensington, and, by the way, I have to thank the department for the loan of some of the most interesting slides I have to show you to-night.)

ABRADING AND STAIN.

The limit of what can be done in the way of variety of color without use of glazing is arrived at by a combination of the two processes of eating away color and staining. You can get by so doing on a single piece of glass white and three colors, viz., (1) the color with which the white is flashed, (2) the yellow stain, and (3) the color resulting from the combination of these two.

I have had a slide made to illustrate this. That is a piece of gray-blue glass; the white is acided out, the yellow is stained upon white (produced by aciding), the green is the silver stain upon the blue. You have there in a single piece of glass, green herbage, yellow flowers, white flowers with yellow eyes, and blue flowers; these last are all that is left of the original tint of the glass. The outlines are traced in brown; the deeper green has a film of the brown over it; a certain russet shade in the leaves is the result of the overfiring spoken of.

A little piece of early sixteenth century Nuremberg work at South Kensington, of which you have a photograph on the screen, illustrates the more pictorial use of both abrading (aciding we should use now) and staining. The flag bearer and his flag are in red and white—the white all got by grinding away the ruby—his glove and sword hilt, etc., are stained yellow. All about him is pale gray-blue glass, but it only tells as such in the sky and in the stream below; the landscape is stained to a rich autumn green; the distant castle and the water mill by the side of the stream are white; the blue, of course, abraded. For small work (such as this) flashed glass and stain open out great possibilities. In larger work flashed glass may be used with advantage in diapering and so on. But the abuse of it leads to a petty kind of treatment not conducive to dignified decoration.

GLAZING.

With regard to glazing. That has to be taken into serious account in the design of a window.

There are difficulties, in the first place, in cutting glass of the thickness and inequality which gives the best color, and possible as it is to cut certain shapes, it is not worth while, for they are sure to get cracked. The face of a window does not long retain its flat and even surface. It bulges under pressure of the wind, bellies like a sail, and as it yields to that pressure, snap go the pieces of glass which were so difficult to cut. A man who knows his trade not only shapes each piece of glass in his design with a view to convenient cutting, but anticipates the fractures which would come when the window gave to the wind. (You can tell from the way even the background to the design is broken up with leads, whether the artist knew what he was about.)

With regard to cutting. The glazier with his diamond does not, you know, cut through the glass, but only into its surface; it has then to be broken, tapped until it falls apart, following, it is hoped, the lines engraved by the diamond; but your hopes will not be fulfilled unless you take into account the natural lines of fracture.

Another consideration with regard to glazing is the strength of the window. You have, as I said, to allow for wind pressure, and then, when the glass would crack, to guard against it by a joint of lead. A window must yield, it should yield equally, and it is actually stronger when made out of pieces more or less of equal size, and none of them in any case very large.

There are many things it is possible to do in the way of cutting and glazing which it is not ordinarily worth while to do.

For instance, you see the stigmata in the hands of Saint Francis on the screen; they are ruby spots, the hands are white, and the white is not flashed ruby ground down to the white, but a hole has been drilled in the white glass and a dot of ruby inlaid and held in place by a ring of lead. A glazier would naturally have attached this ring by cross leads to the lead which marks the outline of the hand.

BARS.

The bulging of the window under stress of wind adds, up to a certain point, to its effectiveness. The various pieces of glass being thus crushed out of the vertical, scarcely two of them are at precisely the same angle to the eye and to the light; and so we get broken light, variety, charm. But, a little too much pressure and the window is blown in!

To keep it safely in its place bars are necessary. These iron bars pierce the stone work, and copper wires, soldered to the leadwork, are tied round them. Bars are usually fixed horizontally across the window, and if it is fairly broad, they must not be too far apart—nine inches or a foot is quite far enough—unless there are upright bars also. (You may employ extra stout bars at longer intervals with more slender ones between.) In any case they, too, have to be considered in the design of the window, or they will considerably mar its beauty.

A plan not often used nowadays is to shape the bars according to the pattern. The schemes of bar arrangements on the screen are from windows of the thirteenth century, when the practice was common. There the bars form, you may say, the skeleton of the design. The plan is suited to designs in which small subjects, or what not, are set in medallions or other ornamental framework.

A detail from Canterbury, to the left of the screen, shows the relation of the bars to the rest of the design, how the skeleton is clothed with glass. You have—

1. Quarterfoil bars.
2. Extra bar.
3. Horizontal bars at regular intervals.

A complete window from Poitiers shows how the bars may, in a less systematic way, follow and emphasize the design.

1. Quarterfoil not outlined, but the square within it gives lines of bars.
2. Cross outlined.
3. Bars accommodate themselves.

Whether you shape your bars, or whether you carry them straight across the window, the point is that they have to be considered from the first—not put in afterward; and I must confess that when an artist does not put them into his cartoon I am inclined to suspect either that he does not know, or does not care, much about glass. Men to whom the window is the thing, and not the drawing, often begin by placing their bars, reserving always the right to shift them, if need be, as the design develops itself.

There may be occasions when a bar must be bent out of its course to escape a feature it would not do to cross—but this is a makeshift and a confession of weakness. One would rather see that a man had made up his mind, to begin with, whether to shape his bars to his design or to design with a view to the use of horizontal bars. Compromise is on the way to nowhere in particular.

GLAZING AND PAINTING.

It is the difficulty of compromising between the conflicting claims of glass and painting which makes glass painting an art in which it is so easy to go wrong. It is plain sailing enough when the painter accepts the lines of the glazier, and fills in with paint, as in the case of a quarry window. The quarry does not go far, but very beautiful work may be done, in which the main lines of the design are the lead work, and the painting is employed to get further and more delicate detail.

In the Dutch window on the screen the square quarries of the glazier are accepted, but the design is not confined within quarries. That is in its way a beautiful bit of domestic work; but, notwithstanding the skill of the designer in adapting his scroll, etc., to the rectangular panes, one cannot but feel that the painting is too delicate for the glazing, or the lines of lead too strong for the painting. Still more obvious is the discrepancy between glazing and painting in Da Udine's windows at Florence. It is well, I think, to accept often the simplest lines of glazing, even square quarries, but they should be accepted entirely, and the design should be more frankly based upon them.

In the round-headed window shown, the leads follow the painter's design. It is an ingenious design, but the leading is not very ingeniously managed. Most beautiful work has been done by the combination of stained glass and glass painting, but the trouble is that there comes a point where the painter says: "I want more even-tinted glass for my painting; these bubbles, for example, in your glass look like an eruption on the lovely face I want to paint; these streaks of variation in the ruby, etc., interfere with the modeling of my drapery, and so on." And the end of it is that he comes to use flatter, more even, and less lustrous material, relying upon paint to give it quality. And so glass comes to grief. His paint does not, in the first place, give the quality of gorgeous color which varied pot metal affords; and in the second, it does not give quite the quality of painting—that transparency which belongs to actual shadow (as though you could see into it) is not to be got in glass, for there the deeper the shadow, the more opaque it must always be.

The unpardonable sin in glass is deep, heavily-painted shadow. There is no reason why the masses of dark necessary to the most powerful effect should not be glazed up in colored glass; then they are luminous, and you get all the quality of glass. In heavily-painted glass you do not get the quality of actual shadow which oil or water color gives you; it is black, or at best muddy.

Ultra delicacy of painting is another snare. The more delicate your painting, the more sorely you are tempted to avoid the use of leads, which may mar it. But, shirk the leads as you may, you can not get rid of them. You may make them creep round the outline of a cloud, a tree trunk or a hillside; you may feather the far side of the lead with grass, and so on; but if the outlines generally are delicate, this one will appear, whatever you do to it, brutal by comparison. And then observe the havoc that time and accident have made with these overdelicate window panes on the screen. There are probably more leads there which are the result of mending than those which were originally in the design.

I am not sure that the objection of the man in the street, or in the church, to leading is not to be accounted for in great measure by his confounding the accidental lines of mending with those designed; and I have known designers deform their work by ugly, awkward, quite unnecessary lead lines under the delusion that they were thereby giving their work the quality of glass. That is mere ignorance. Still leads must, it seems to me, give the keynote of the drawing, the pitch to which delicacy of painting may be carried. In many beautifully painted windows the lead lines, just because they have been shirked, and only occur where they were inevitable, assert themselves unduly. The face, for example, of the man in the dark cloak on the screen is lost for want of the emphatic outline of lead round the rest of the figure. The fact is, lead necessitates at least some correspondingly strong lines in the painting; here the little patches of black come in usefully in support of the leads, and there is no objection to this use of solid black as local color in very little bits as here; these are quite small subjects. On a large scale it would be better to glaze up these points of dark in pot metal. I should say that this glass is of the sixteenth century, long before Vierge invented the cunning patch of black.

Some of the happiest effects of delicate painting upon glass are where a distant landscape, or what not, is painted upon a pale blue ground which stands for sky. The effect of this is sometimes curiously atmospheric; but the success comes of accepting a convention. The distant view is confessedly painted upon the background tint, and though the hills and trees are stained green and white clouds abraded, there has been no attempt at naturalistic effect, and no consequent loss of the quality and character of glass.

Delicacy of painting tempts to the use of soft flux (borax, etc.), readily fired and dissolved by action of the weather. It is a fact, not a palatable one to the artist, that soft pigment means perishable pigment. The safest, if not the only, way really to fix paint is to burn it thoroughly in, to use hard color, painting heavier than you want, and firing it again, and so on.

It is a great question whether delicacy of painting is a thing worth the sacrifices made to get it in glass. I do not think it is. If you can get it in addition to all else, good; but it is not worth giving up for it qualities which belong to glass. What about the pictorial, then? How far is picture permissible? It all depends upon what you mean by picture. The pictorial idea of the early Italian masters may perhaps be attained in glass. The ideal of the great Dutchman or of the great Spaniard is incompatible with glass painting. And so of course is the ideal of the "plein air" school and the modern pictorial ideas generally. The modern painter wants to get much more than glass will give.

ENAMEL.

The paint so far spoken of has been the brown pigment used for black or shadow, not for color at all. It is, if you like, an enamel; but it saves confusion to reserve the term "enamel" for color used for color's sake upon the glass. Roughly speaking, this may be described as finely ground colored glass mixed with something to make it melt easily in the fire, and so become fused more or less perfectly (or imperfectly) on to the glass. Some of these enamel colors will stand more fire than others, but few of them will stand fire enough to make them really one with the glass. Excepting only small Swiss panes (all honor to the Swiss craftsmen), enameled windows have invariably suffered severely in the course of two or three centuries; so much so that you can always detect enamel by the specks (if not whole patches) of white light coming through where it has caked off. For other than miniature work (in the shields on the screen, for example, which are not much bigger than postage stamps), enamel seems to me scarcely worth serious consideration. For church and other big windows, so far is it from necessary, that it is better to limit yourself to mosaic, which compels you to a breadth which makes for decoration.

CHINA RED FLESH.

The temptation to use enamel red in flesh painting has not been sufficiently resisted. Flesh color is just the one pot metal color which has not been satisfactorily got. The brownish pink used is not pleasant, and I think it is apt to go purpler in the fire. The best results have been obtained, to my thinking, by frankly accepting the convention of whitish flesh. If there is plenty of white glass in the window, it helps to carry the white through; and there is something monumental about this flesh so removed from nature. However, from the 16th century downward, a warm color

has been used in flesh painting—beautiful work has been done—but the effect is not so fine, I think, as where merely brown is used. After all, you can't get anything like flesh, with its gray tones; you only get a hot monochrome instead of a cool one. Better accept the more manly and more monumental convention.

CONCLUSION.

The root, if not of all design, of all design that can be called decorative (and stained glass is nothing if not that)—the root of all decorative design is the material in which it is done, out of which, I may say, it is to grow. An artist can only get out of his material what is in it, and he can only bring out what is in it by, so to speak, humoring it. He shows himself most an artist when he most honors it, using it, that is to say, and not abusing. I don't mean to say that the master craftsman is the slave of his material (it tyrannizes, of course, over the ignorant); he has studied it until he knows it, and he can bend it his way. He guides it, as a woman does her husband, without his knowing it; but, like her, he knows how far it is safe to go, and stops discreetly short of the point at which the stubbornness innate in materials (no less than in man) asserts itself at last. And how stubborn things are when you cross their grain! The wise workman works with the grain, flatters the material perhaps, coaxes it certainly into the way he wants it to go; it is to be led (if you know how) but not compelled, and, to lead, you must know.

GREEK AND ROMAN DINING ROOMS.

THE dining rooms of the ancients are best described by Vitruvius (lib. vi., cap. 10). In one of the largest Grecian houses the common dining rooms for the family he describes as being under the porticoes of the peristyle, and in the portico which looked to the north the cyzican triclinium, or chief dining room, and the pinacotheca, or picture and statue gallery. On the right and left also of the mansion or main building small houses were erected, having proper gates, dining rooms and convenient chambers, that when strangers arrive they may not enter the peristyle, but be received into this hospitalium, for when the Greeks were more refined and opulent they prepared triclinia (dining rooms), cubicula, or chambers, and provisions for strangers, the first day inviting them to dinner, afterward sending them poultry, eggs, herbs, fruits and other productions of the country. Masters of families, therefore, when they abode in this manner, seemed not to be from home, enjoying the full liberty of retirement in these apartments. The triclinia, or dining rooms, of the Romans, with the proceston, or room for attendants, the cubicula with the baths, etc., were disposed on the sides of the cavædium. Vitruvius directs that the winter dining room and bath should look to the winter's declining sun, because the afternoon light is there useful; besides, the western sun shining thereon produces heat, and makes that aspect warm and pleasant in the evening. The spring and autumn dining rooms (for the luxurious Romans had one for every season of the year) should look to the east, for the windows then being turned from the sun, which is proceeding westward, render those rooms temperate at the time they are generally used. The summer dining room should look to the north, because this aspect is not, like the others, rendered hot at the summer solstice; for, being turned from the course of the sun, it remains always cool, and when used is salubrious and pleasant. Pliny describes the dining rooms at his Laurentinum as being beyond the portico, through a pleasant cavædium, and which advanced upon the shore, so that it was gently washed by the waves when the south wind blew. On every side were folding doors or windows as large, so that from the sides and the front he enjoyed a prospect as it were of three seas, and backward were to be seen the cavædium, the portico and the area; again the portico and atrium terminated by woods and distant mountains. On the left of the triclinium, but not so forward, is a large cubiculum and then a smaller one, where one window admits the rising and another the setting sun. From hence you view the sea rather more distant, but more securely. This cubiculum and dining room by their projection formed an angle, which not only retained, but augmented the heat of the sun's rays. On the right side of the dining room was a most elegant cubiculum, with another large cubiculum, or moderate cænatia (common eating or supper room), which receives light both from the sun and the sea.—The Architect.

An engineer of Cracow, Malachowski, has devised a valuable instrument, by means of which plant and animal life can be studied under water, and ships' hulls and bridge piers be examined. The instrument is practically a binocular with a long tube, says Engineering. It consists of three parts, the lenses, the diverging tube made of zinc, and the closed box into which the zinc cone fits. The box is made of sheet iron, has a diameter of about one foot, and is closed below by a strong glass plate packed between rubber washers. In order to protect the plate from stones, the box is provided with iron feet. The field of view under the plate is illuminated by an electric incandescent lamp, which is held by a bent arm. Another lamp can be fixed in a short branch tube starting from the box. This branch, which is hermetically closed, is needed, because the moisture would condense on the inner face of the glass plate, if this face were not carefully painted with pure vaseline. To do this, the box must be accessible. Weights are required to overcome the hydrostatic pressure, that pressure might crush the glass plate, and the water rushing up damage the lenses and the eye of the observer, were it not that such water would find an exit through an opening in the upper part of the tube. Capt. Muzyka, whose short description in the Mittheilungen über Gegenstände des Artillerie- und Genie-Wesens we follow, states that Malachowski has experimented with tubes 50 feet long. The electric wires are carried down inside the tube. When lateral observations are to be made, as will generally be the case on board ship or for operations connected with hydraulic engineering, the inventor employs a different box, in which a mirror is placed at an angle of 45°. We do not know how far the experience of the inventor extends, but he seems to have overcome the more apparent difficulties.

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